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UNDERWATER FACILITIES INSPECTIONS AND ASSESSMENTS AT
NAVAL TRAINING CENTE. (U) BLAYLOCK-HILLIS AND
ASSOCIATES SAN DIEGO CA OCT 84

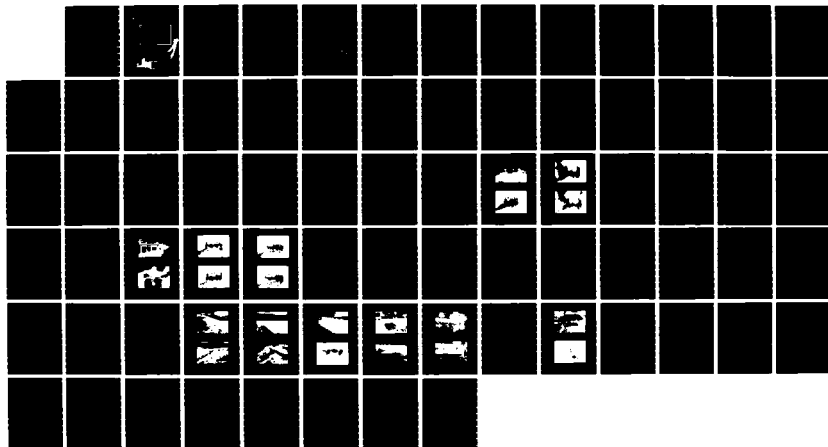
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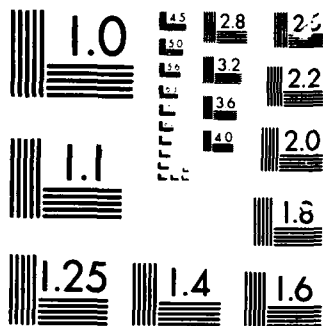
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UNDERWATER FACILITIES INSPECTIONS & ASSESSMENTS



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CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON, D.C. 20374

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An inspection was made of certain facilities at the Naval Training Center
during the period August 20 to August 28, 1984.

The principal object was to provide that quality of inspection that would
allow the engineer inspector/divers to assess the general physical (Con't)
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condition of Bulkheads and the piling of the Piers, inspected. Each facility ~~was inspected~~ using non-destructive techniques. Typical and critical elements were photographed.

The facilities inspected and the recommendations regarding each of them as follows: 1) Pier 548 - The 12 inch square concrete piles supporting the access pier and the 12 inch concrete guide piles of the floating piers are in good condition. 2) Pier 445 - The 12 inch concrete piles of the access structure are in good condition. The dry pack material at the top of each of these piles is deteriorating and should be replaced. The 30 inch octagonal guide piles of the floating section are in excellent condition. The wooden guide piles should be replaced in four years at an estimated cost of \$10,000. 3) South Boundary Bulkhead - The Bulkhead is in good condition. Two small voids have formed at construction joints in wall and should be filled with a light cemented material at an estimated cost of \$1,000. 4) Pier 548 Bulkhead - This reinforced concrete retaining structure is in good condition but undermined at one end. It is recommended that the resulting void be filled with cemented material at an estimated cost of \$1,000. 5) Pier 446 Bulkhead - The wooden retaining structure is badly dry rot deteriorated. It is recommended that it be replaced within two years or adjacent parking be restricted. It is estimated that the cost of replacement will be \$76,900. 6) Pier 445 Bulkhead - This wooden retaining structure is also badly dry rot deteriorated. It is recommended that it be replaced as soon as possible. The cost estimate for replacement is \$33,800. 7) North Boundary Bulkhead - The wooden Bulkhead is badly dry rot deteriorated. It is recommended that it be replaced. The estimated cost of replacement is \$62,800. 8) Boat Ramp - The toe of the ramp is undermined. Fill void with aggregate deposited at the end of the ramp at an estimated cost of \$2,500.

1

UNDERWATER FACILITIES

INSPECTIONS

AND

ASSESSMENTS

AT

NAVAL TRAINING CENTER
SAN DIEGO, CALIFORNIA

FPO-1-84(21)

OCTOBER 1984



PERFORMED FOR :

OCEAN ENGINEERING AND CONSTRUCTION PROJECT OFFICE
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON, D.C. 20374

CONTRACT: N62477-83-D-0190-0002
TASK 2

BY: BLAYLOCK-WILLIS AND ASSOCIATES
1909 MC KEE STREET, SAN DIEGO, CALIFORNIA 92110

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EXECUTIVE SUMMARY

An inspection was made of certain facilities at the Naval Training Center during the period of August 20, 1984 to August 28, 1984.

The principal object was to provide that quality of inspection that would allow the engineer inspector/divers to assess the general physical condition of Bulkheads and the piling of the Piers inspected. Each facility was inspected using non-destructive techniques. Typical and critical elements were photographed.

The facilities inspected and the recommendations regarding each of them are as follows:

1. Pier 548 - The 12 inch square concrete piles supporting the access pier and the 12 inch concrete guide piles of the floating piers are in good condition.
2. Pier 445 - The 12 inch concrete piles of the access structure are in good condition. The dry pack material at the top of each of these piles is deteriorating and should be replaced. The 30 inch octagonal guide piles of the floating section are in excellent condition. The wooden guide piles should be replaced in four years at an estimated cost of \$10,000.
3. South Boundary Bulkhead - The Bulkhead is in good condition. Two small voids have formed at construction joints in wall and should be filled with a light cemented material at an estimated cost of \$1,000.



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4. Pier 548 Bulkhead - This reinforced concrete retaining structure is in good condition but undermined at one end. It is recommended that the resulting void be filled with cemented material at an estimated cost of \$1,000.
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6. Pier 445 Bulkhead - This wooden retaining structure is also badly dry rot deteriorated. It is recommended that it be replaced as soon as possible. The cost estimate for replacement is \$33,800.
7. North Boundary Bulkhead - The wooden Bulkhead is badly dry rot deteriorated. It is recommended that it be replaced. The estimated cost of replacement is \$62,800.
8. Boat Ramp - The toe of the ramp is undermined. Fill void with aggregate deposited at the end of the ramp at an estimated cost of \$2,500.

NAVAL TRAINING CENTER
SAN DIEGO, CALIFORNIA
EXECUTIVE SUMMARY TABLE

FACILITY	YEAR BUILT OR MODIFIED	NO. & TYPES OF PILE IN STRUCTURE	SIZE (AREA) (LENGTH) FT ² FT.	STRUC
Pier 548	Built 1975	10 Concrete bearing 32 Concrete guide	864 Fixed 6940 Floating	12" S ally in
Pier 445	Built 1923	8 Concrete bearing 2 Concrete guide 3 Wood	682 Fixed 3060 Floating	12" S conve 20" Oc P/S. 16" di
Bulkheads				
South Boundary	Not known	Concrete	245	Cast in
Pier 548	Not known	Concrete	87	Cast in
Pier 446	Not known	Wood	118	Wood p zontal
Pier 445	Not known	Wood	28	Vertica Horizon cast in
North Boundary	Not known	Wood	45	Vertica Horizon assume
Boat Ramp	Not known	Concrete	896	Reinfor slab, c

122

AL TRAINING CENTER

DIEGO, CALIFORNIA

FIVE SUMMARY TABLE

SIZE AS (LENGTH) FT.	STRUCTURE	RECOMMENDATIONS	TOTAL REPAIR COST \$
Fixed Floating	12" Square convention- ally reinforced piles.	None	
Fixed Floating	12" Square bearing, conven. reinforced. 20" Octagonal guide, P.S. 16" dia. wood	None Replace wood piles	 \$10,000
45	Cast in place concrete.	Fill small voids	\$ 1,000
47	Cast in place concrete.	Fill undercut	\$ 1,000
110	Wood piles with hori- zontal lagging.	Replacement	\$79,600
11	Vertical lagging, Horizontal wale, some cast concrete.	Replacement	\$33,800
65	Vertical lagging, Horizontal wale, assumed tie backs.	Replacement	\$62,800
	Reinforced concrete slab, cast in place.	Fill voids at end	\$ 2,500

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SECTION 1 - INTRODUCTION

1.1 CONTRACT DATA

Contract N62477-83-D-0190-0002 - Ocean Engineering Services in Support of Underwater Assessments at Various Locations.

This task required engineering services to document an underwater inspection and subsequently assess the integrity of the structural members supporting waterfront facilities at the Naval Training Center, San Diego, California.

1.2 INTRODUCTION TO THE PROJECT

This inspection and assessment has been prepared under the Underwater Inspection Program conducted by the Ocean Engineering and Construction Project Office (FPO-1), Chesapeake Division, Naval Facilities Engineering Command, as part of NAVFAC's Specialized Inspection Program. It covers the inspection of Pier 548, Pier 445, concrete Bulkheads at Pier 548 and Pier 9 as well as short sections of wooden Bulkheads at Pier 445, Pier 446, and at the Channel boundary with the Marine Corps Recruit Depot. The inspection was specifically oriented to the assessment of the physical condition of the concrete and wood structural piles of the Piers and to the condition of the concrete and wood elements of the Bulkheads. In addition, attention was addressed to the condition of the waterside end of the small boat ramp east of Pier 445.

1.3 POST INSPECTION BRIEFING

Following standard practice in the Underwater Inspection Program, a briefing was given to Naval Training Center Public Works on 24 August 1984 by Mr. Christopher Crilley of Chesapeake Division,

Naval Facilities Engineering Command and Mr. A. J. Blaylock of Blaylock-Willis and Associates. Attendees were Lt. Cdr. G. E. Reynolds, Staff Civil Engineer, NTC Code 17 and Mr. Ralph Simpson, NTC Code 17.3. The observations of the inspection prior to structural analysis were provided as a "heads up" on the apparent overall condition of the facilities. Subsequent engineering analysis, as indicated in this report, have elaborated on these observations with no significant changes in the general conclusions.

SECTION 2 - ACTIVITY DESCRIPTION

2.1 LOCATION

The Naval Training Center, San Diego, California, is located on the North side of San Diego Bay west of Lindbergh Field about five miles inboard of the entrance to the Bay. The total land area of the base is approximately 550 acres.

2.2 HISTORY (1)(2)

In 1919, an area of tidelands and the Point Loma Bay Shore was awarded to the Navy for a training center. The original grant included 135 acres of highland donated by the San Diego Chamber of Commerce and 142 acres of tidelands given by the City of San Diego. Construction of the facility began in 1921. On 1 June, 1923, the Naval Training Station, San Diego was commissioned. The station then consisted of 25 permanent buildings on about 277 acres of land. Between 1923 and 1939, the Station grew to 59 buildings.

By 1940 through the utilization of hydraulic fill, operations which were responsible for the Lindbergh Field and County Administration Building sites, the land area of the Station had expanded to 500 acres.

In April, 1944, the Secretary of the Navy officially redesignated the status of the Training Station to that of a group command and established the Naval Training Center, San Diego. It is presently one of three such Training Centers in the United States.

(1) Bibliography, Page 1.1

(2) Bibliography, Page 1.

2.3 MISSION

The mission of the Naval Training Center, San Diego, is to exercise command over and coordinate the efforts of the assigned subordinate activities in effecting basic indoctrination (recruit training) for enlisted personnel and initial skill, advanced and/or other specialized training for officer and enlisted personnel of the regular Navy and the Navy Reserve and to support other activities as directed by higher authority.

2.4 ENVIRONMENTAL DATA (3)

The climatic region of San Diego is classified as dry steppe (BSk) Kopen-Geiger classification system. The climate is characterized by ocean-influenced mild temperatures and light to moderate precipitation, primarily during the winter months.

The average annual rainfall recorded at Lindbergh Field adjacent to the Naval Training Center is 10.4 inches. Heavy fogs occur in San Diego Bay approximately 24 days per year, most frequently in the Fall and Winter months.

Air temperature has an annual mean of approximately 63 degrees F. Coldest temperatures (45 degrees to 60 degrees) generally occur in January, and the warmest (68 degrees to 75 degrees) in August and September. Temperatures within the San Diego Bay immediate area are more moderate than the surrounding upland areas.

Characteristic of the Bay area is the predominant sea-land breeze which persists as a westerly daytime wind, sometimes with a countering easterly land breeze at night. The average wind

(3) Bibliography

velocity at Lindbergh Field is 6.6 knots. Strong winds or gales are infrequent. The maximum wind recorded in San Diego occurred in November of 1944. It was from the southwest and 51 mph.

The larger San Diego area is subject to adverse meteorological conditions that are conducive to the concentration of air pollutants (smog). However, the Bay area experiences fewer air quality impacts due to the prevailing westerly winds and the absence of significant pollutant sources to the west.

San Diego Bay is crescent-shaped, about 22 miles long, and from 1/4 to 2-3/4 miles wide. It covers 18 square miles and contains 300,000,000 cubic yards of water at mean tide. The Bay tidal prism (the volume of water contained between high and low tide horizontal planes) is about 1/3 of its total volume.

Water depths in the northern section of the Bay generally exceed 30 feet, with about 70 feet maximum.

Average tidal range is 5.6 feet and extreme range is 10.0 feet. The maximum tidal currents at the facilities addressed in this report are less than 2 feet per second.

Historically, the Bay floor and margins are characterized by formational materials, sand, silt, clay and mud deposits. Mud deposits characterize eastern and southern margins of the Bay.

Past dredging activities have removed most of the mud deposits in the Bay so that medium dense, silty sands are encountered a few feet below the existing bottom. The deeper deposits are quite dense and exhibit considerable structural competence.

The State of California is within an active seismic region. San Diego has experienced mild earthquakes in recorded history, but none have been catastrophic.

There are several fault systems in Southern California which must be considered in making a seismic assessment of the Naval Training Center for potential earthquake damage. These include the Rose Canyon and La Nacion Faults which are in the vicinity (five miles and eleven miles respectively), the Elsinore Fault located 50 miles to the east, the San Jacinto Fault 75 miles distant to the east, and the San Andreas Fault 85 miles to the east. It is understood that the largest probable magnitude earthquake would be generated by the San Andreas Fault (8.3 Richter scale). However, the San Jacinto Fault with a maximum probable magnitude of 7.8 could produce the largest ground acceleration in San Diego due to its closer proximity. That acceleration is estimated to be 20 percent g (gravity).

As described above, some of the Naval Training Center is reclaimed tidelands produced by dredged fill. These soils are susceptible to liquifaction in the presence of strong seismic energy waves, with resulting threat to existing structures.

Water quality in San Diego Bay is presently acceptable for most human activities, including water recreational purposes. In recent history, it has not always been this good. The first collection plant for area sewage was constructed by the City in 1887 to collect the random discharges that were polluting the Bay. The pollution had been so concentrated that the Navy had expressed concern that the Bay waters were affecting the paint on naval vessels. However, untreated and partially treated sewage continued to be discharged into the Bay by the surrounding communities until 1963.⁽⁴⁾

At that time, industrial and municipal sewage discharges were required to flow into the San Diego Metropolitan Sewage System. This system discharges its effluent into the ocean west of Point Loma.

(4) Bibliography

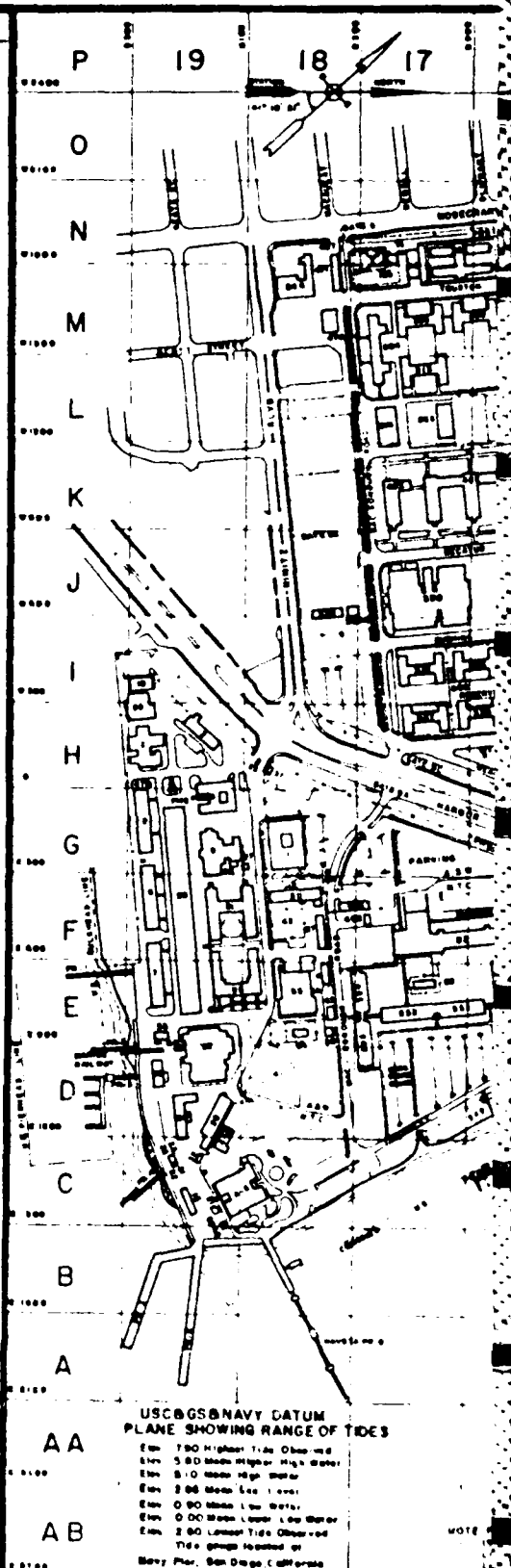
The concentration of sulphate ion in open ocean water is high enough to create an environmental hostile to Portland cement concrete. The additional sulphate ion concentration caused by the previous sewage discharge into the Bay magnified the problem..

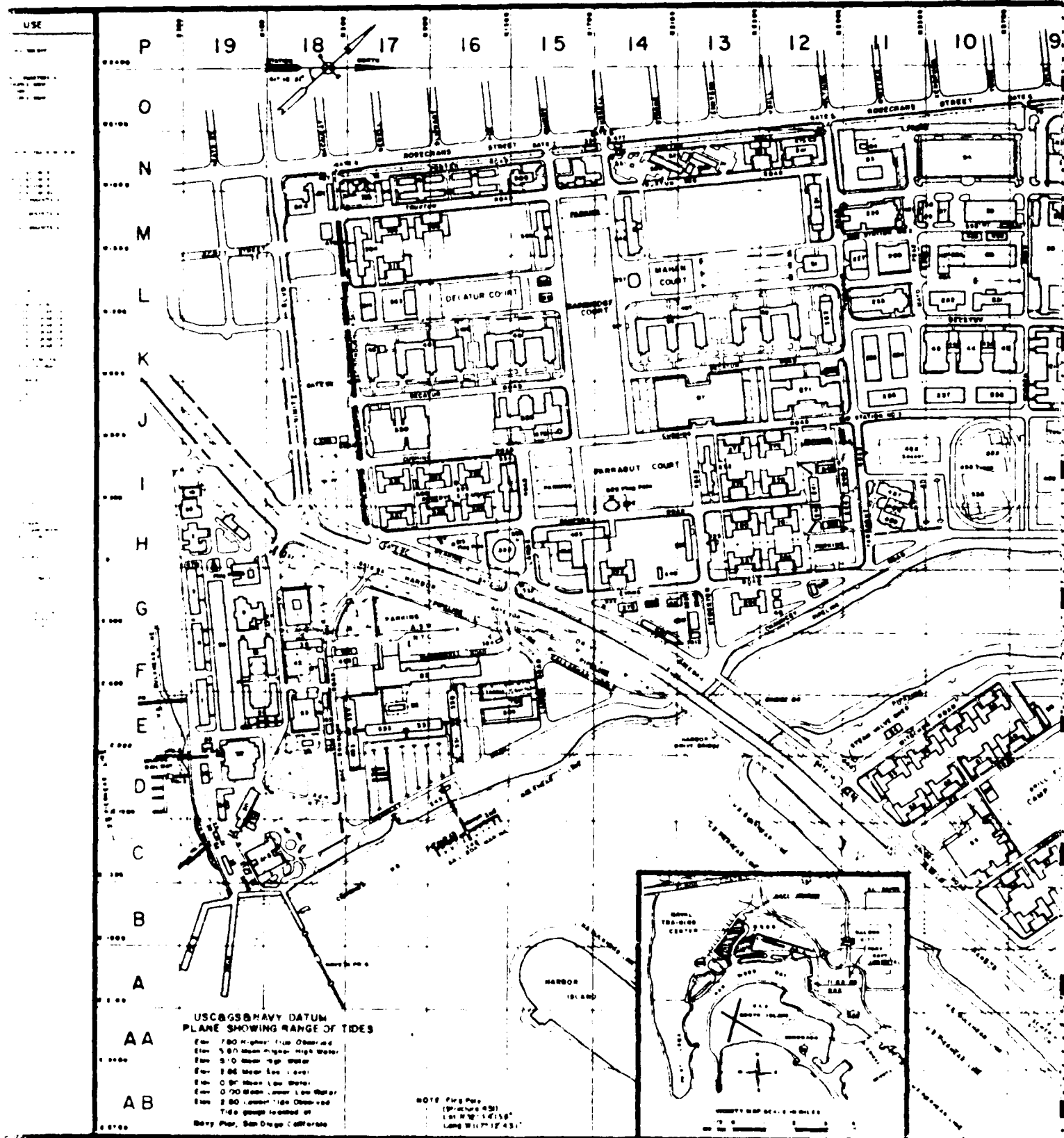
Reinforced concrete facilities in the Bay have suffered varying degrees of sulphate damage. This damage is characterized by surface softening of the concrete. However, none of the facilities investigated at NTC exhibited sulphate damage.

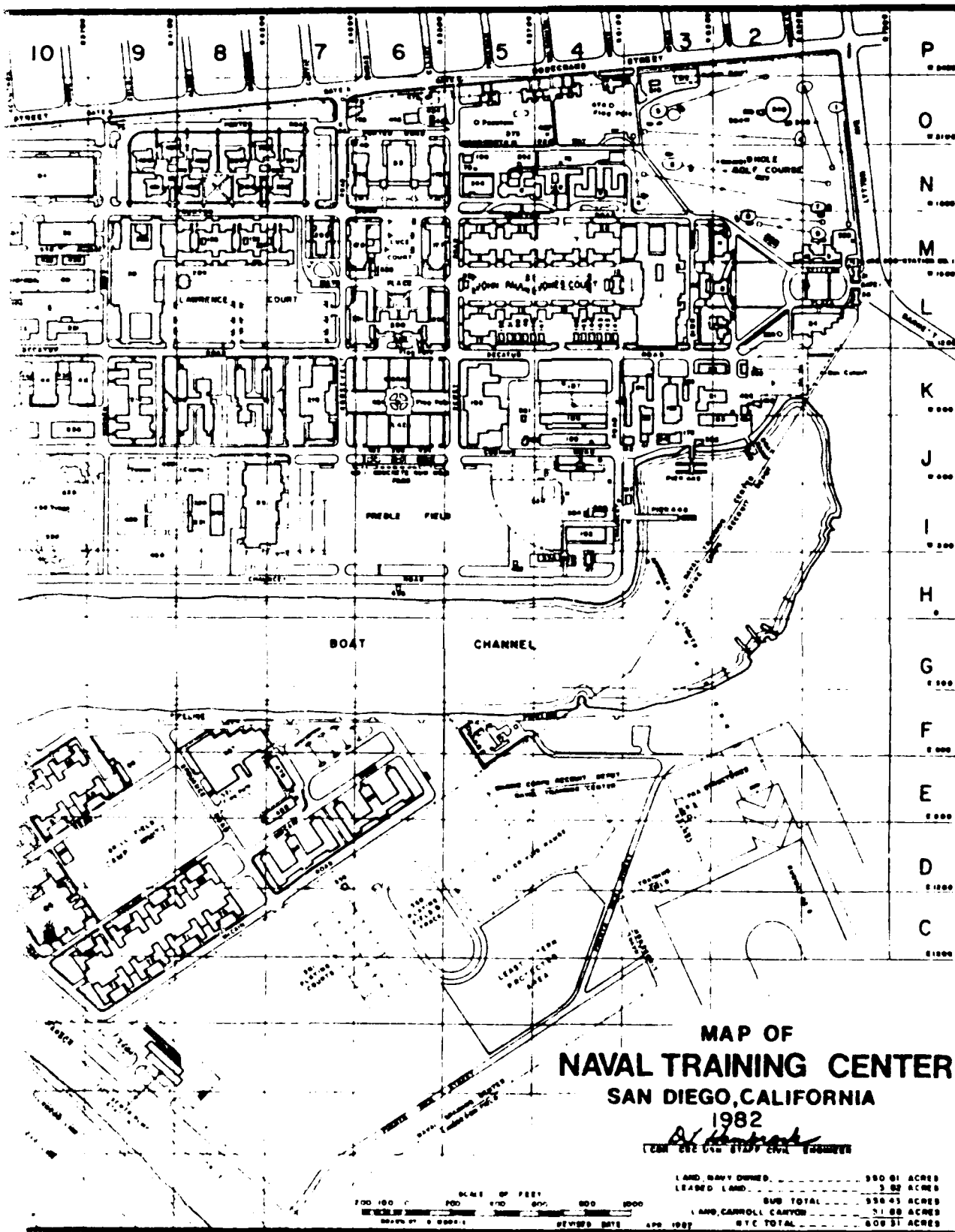
Marine vegetation exists within San Diego Bay in the forms of various species of algae and one species of sea grass. The sea grass grows in the calm water near shore areas adjacent to the Training Center. Marine algae are represented by large filamentous forms of red and green algae such as witches hair or mermaids hair. In addition, forms of green algae such as sea lettuce are found attached to rocks and marine structures. Over 200 species of marine invertebrates have been found. Sediment samples reveal infaunal organisms, including many species of polychaetes, small crustaceans and various bivalves.

Marine invertbrates found on pier piling, rocks, and marine floats include lobsters, crabs, worms, mussels, barnacles, echinoderms, sponges, sea anemones, and tunicates. Eighty to ninety different fish species live in the Bay.

NO	LOC	USE	NO	LOC	USE	NO	LOC	USE
1	100	OFFICE	101	100	OFFICE	102	100	OFFICE
2	100	OFFICE	103	100	OFFICE	104	100	OFFICE
3	100	OFFICE	105	100	OFFICE	106	100	OFFICE
4	100	OFFICE	107	100	OFFICE	108	100	OFFICE
5	100	OFFICE	109	100	OFFICE	110	100	OFFICE
6	100	OFFICE	111	100	OFFICE	112	100	OFFICE
7	100	OFFICE	113	100	OFFICE	114	100	OFFICE
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SECTION 3 - INSPECTION PROCEDURE

3.1 LEVEL OF INSPECTION

The on-site underwater inspection phase of the work was performed by teams composed of registered engineers with one engineering technician tendering some of the time. All inspections were conducted in the period between August 20 and August 28, 1984.

Photographs were taken by a commercial underwater photographer supported by the engineering team on August 28, 1984.

The inspection techniques were dictated by the requirements of the Scope of Work and the need for that quality of inspection that would yield the proper information to support accurate assessment and recommendation for the structure inspected.

3.2 INSPECTION PROCEDURE

The work was conducted using two engineering divers with a technician as tender. The divers were in the same vicinity at all times so that the single tender did not represent a violation of safe diving standards. Communication between diver and tender was by voice.

A Level I general examination was performed on all Pier piles within each of the open type structures. The Level I examination is essentially a swim-by overview which does not involve cleaning of any structural elements.

The bulkhead Level I examination included an observation of the walls all of which were above water.

A Level II examination was performed on 6 concrete piles of Pier 445 and 7 piles of Pier 548. This included hand cleaning of biofouling or debris on three sides or faces of each square pile or six sides of each octagonal pile to an approximate length of 10 inches to expose underlying pile surface at three heights: mean low water, mudline, and halfway between those elevations.

The concrete piling were then struck with a pointed hammer at all three elevations to gauge the soundness of the concrete. That soundness was then recorded according to the following nomenclature:

1. Hard: Pick rebounds without making a significant indentation, usually accompanied by a ringing sound clearly heard in the water.
2. Firm: Pick rebounds with a small indentation.
3. Soft: With six blows, 1/4 inch to 1/2 inch indentation can be made.
4. Very Soft: Six blows removes corner of the pile or in excess of 1/2 inch of material.

Record of structural assessment of the concrete sheet piles is shown in Tables 5.1 and 5.2.

Chipping was attempted at all four exposed corners at each elevation of all bearing piles and the soundness was recorded.

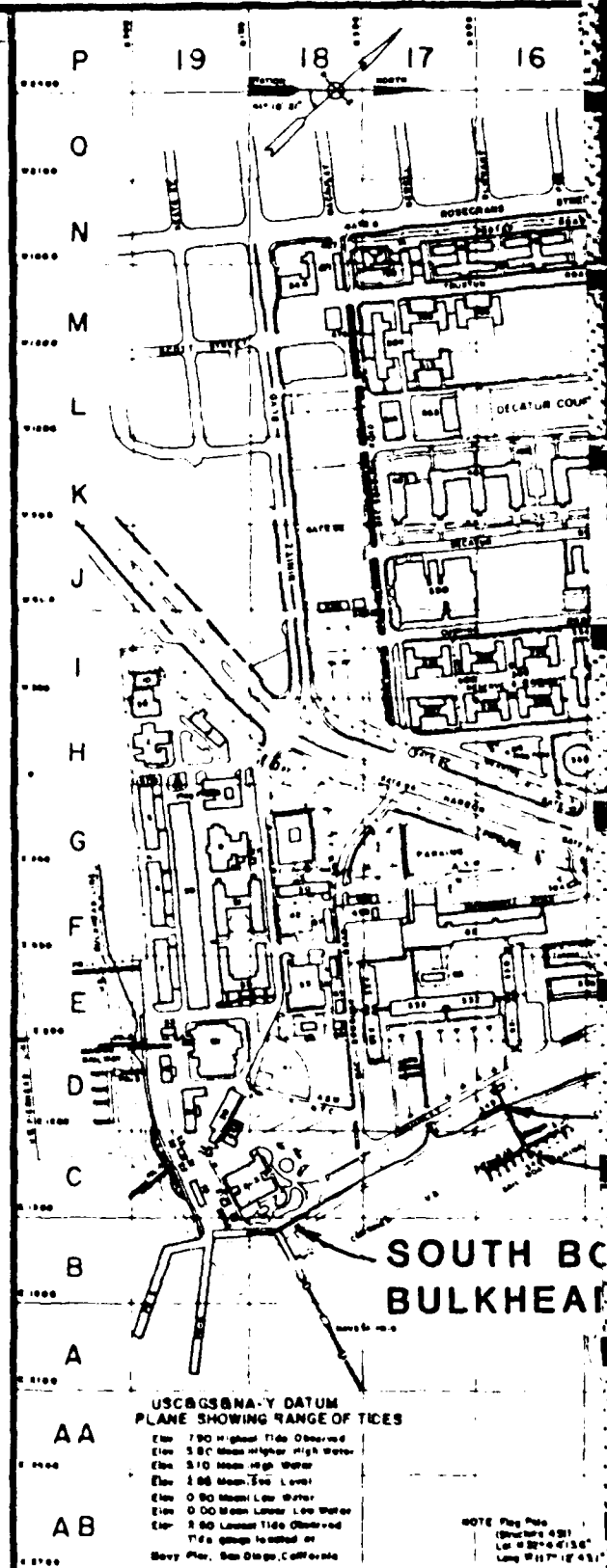
Each pier pile was inspected at its upper connection to the cap beam for evidence of driving fracture.

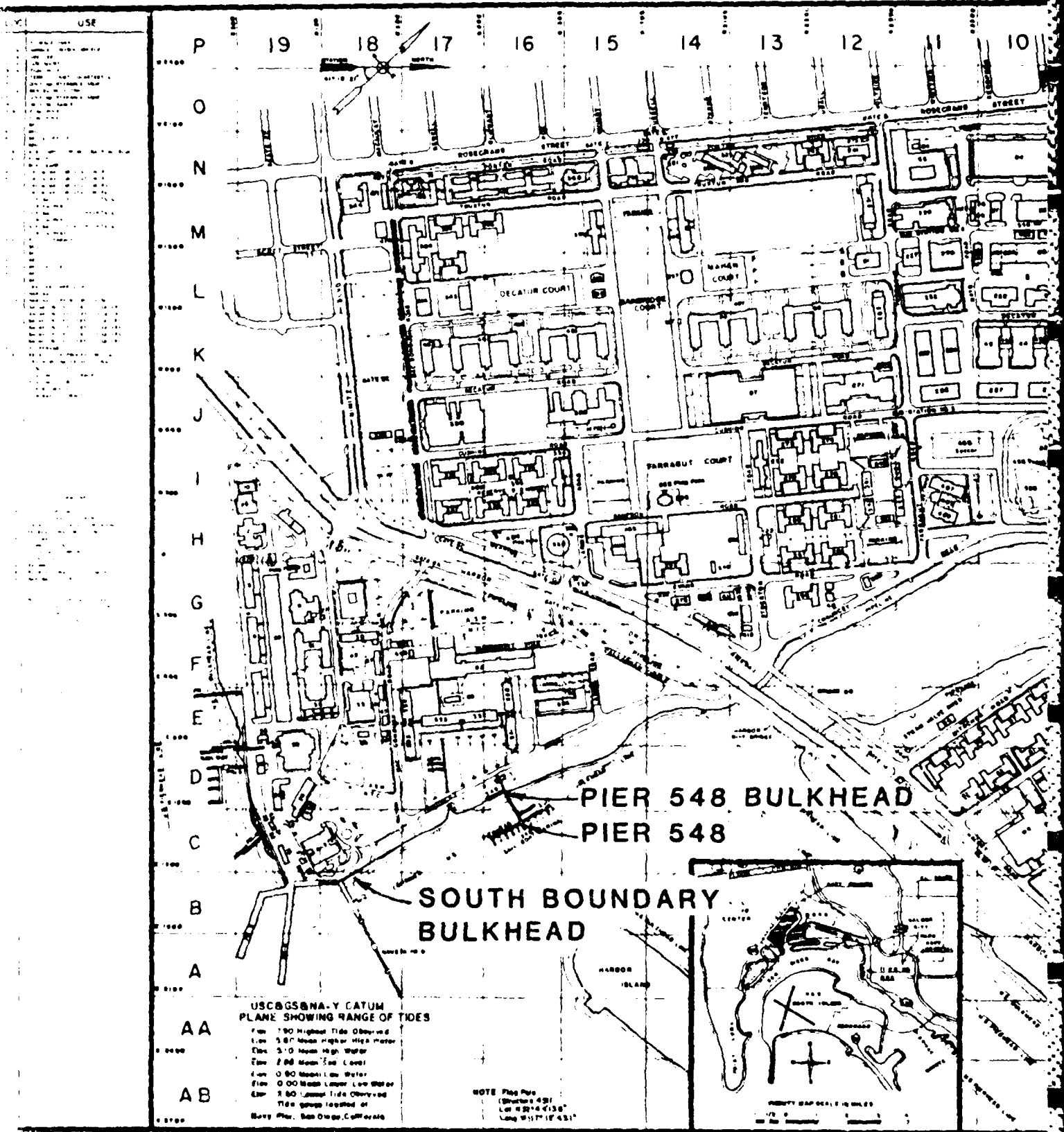
It should be noted that non-destructive methods of inspection were used in this project. The conditions noted reflect direct observation coupled with a knowledge of similar facilities gained by this office from 25 years of experience with the waterfront structures.

3.3 INSPECTION EQUIPMENT

Equipment used included the usual divers' equipment with scuba gear. Photography equipment included a Nikonos III camera with 15mm wide angle lens and two SR 2000 strobe lights. Chipping hammers and bar scrapers were used to clean and test the piles.

NO	LOC	USE	NO	LOC	USE	NO	LOC	USE
1	100	100	101	101	101	102	102	102
2	100	100	101	101	101	102	102	102
3	100	100	101	101	101	102	102	102
4	100	100	101	101	101	102	102	102
5	100	100	101	101	101	102	102	102
6	100	100	101	101	101	102	102	102
7	100	100	101	101	101	102	102	102
8	100	100	101	101	101	102	102	102
9	100	100	101	101	101	102	102	102
10	100	100	101	101	101	102	102	102
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12	100	100	101	101	101	102	102	102
13	100	100	101	101	101	102	102	102
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29	100	100	101	101	101	102	102	102
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31	100	100	101	101	101	102	102	102
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43	100	100	101	101	101	102	102	102
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45	100	100	101	101	101	102	102	102
46	100	100	101	101	101	102	102	102
47	100	100	101	101	101	102	102	102
48	100	100	101	101	101	102	102	102
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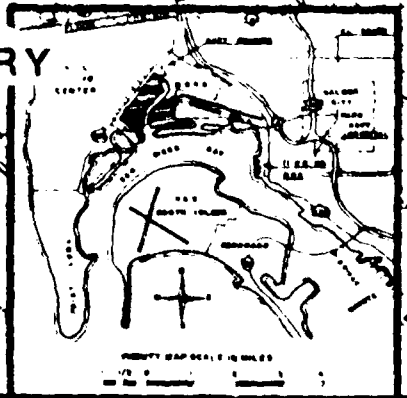


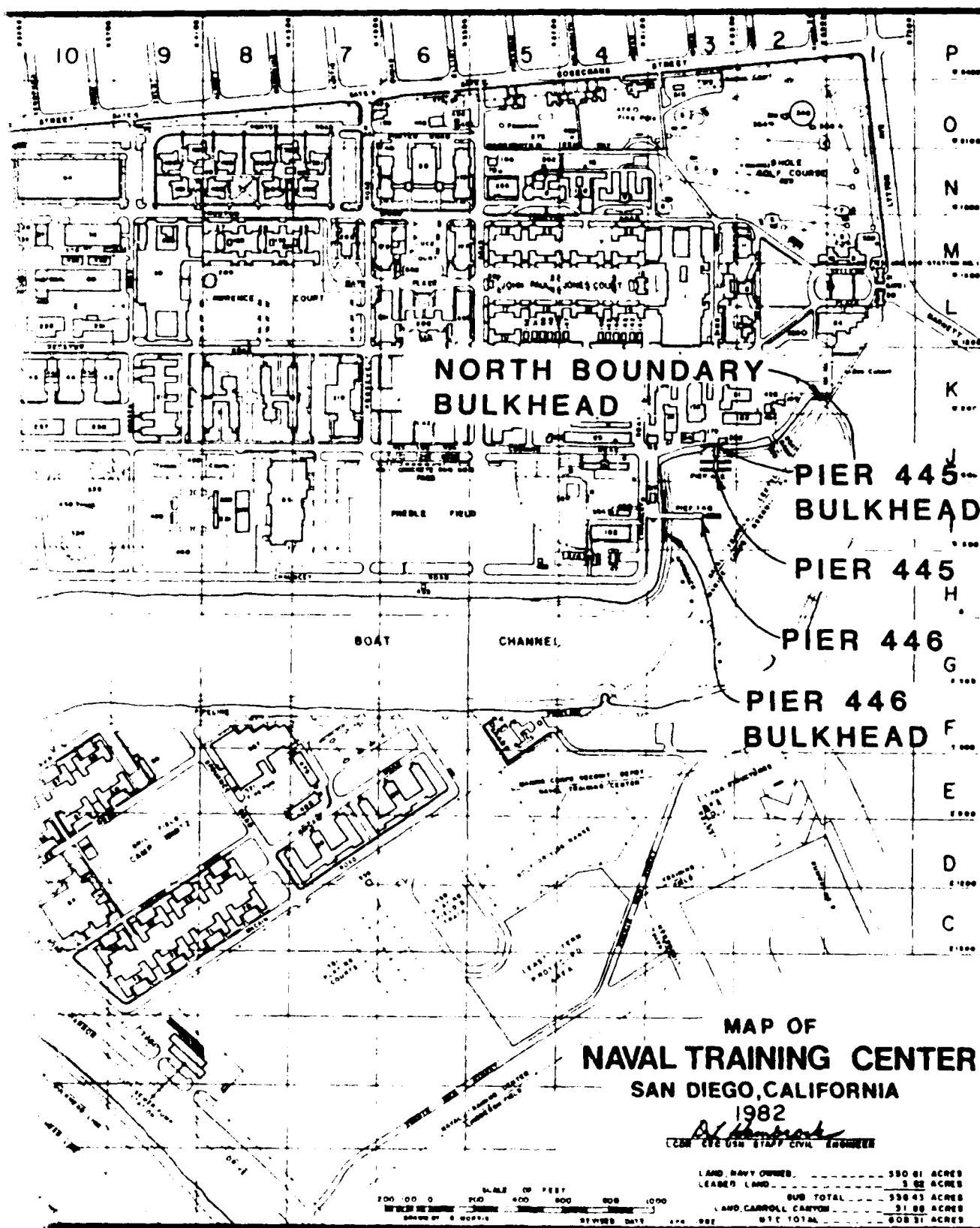


USCGS NA-1111
PLANE SHOWING RANGE OF TIDES

1.00	Highest Tide Observed
1.67	Mean Higher High Water
3.00	Mean High Water
2.00	Mean Tide Level
0.00	Mean Low Water
0.00	Mean Lower Low Water
2.00	Lowest Tide Observed
Tide gauge located at	
Battery Point, San Diego, California	

NOTE Flag Pole
(Structure 431)
Lat. 32° 44' 43.8"
Long. 117° 17' 43.1"





SECTION 4 - FACILITIES INSPECTED

4.1 PIER 548

4.1.1 DESCRIPTION OF THE FACILITY

Pier 548 is also known as "The Small Boat Marina". It is located in the section of NTC south of Harbor Drive and 1100 feet south of Harbor Drive Bridge.

The pier was constructed in 1975 from plans prepared for the Public Works Center, San Diego, California (See NAV. FAC. Drawing No's. 6037828 thru 6037834, Code Identification No. 80091). It consists of an access pier, a brow and floating walkways, a floating landing pier and floating finger piers.

The access pier is a fixed pier supported on five - 2 pile bents. The piles are 12 inch square prestressed concrete units. The floating section is supported by 34 - 12 inch square guide piles. These piles are also prestressed.

4.1.2 OBSERVED CONDITIONS

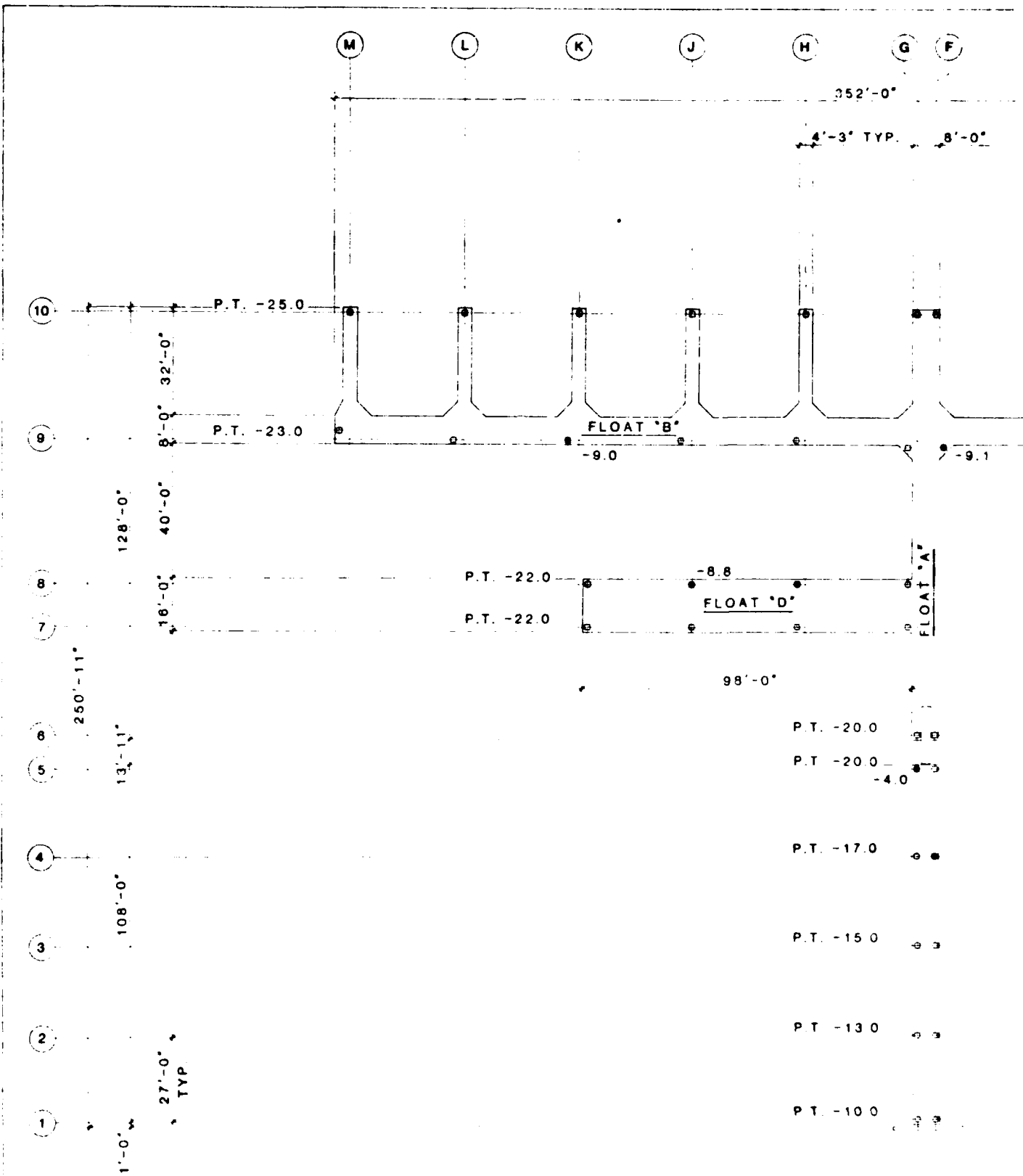
The concrete piles were picked with pointed hammers as described above and the underwater surfaces all rated "firm" in the scale of hardness. The only pile damage observed was limited to spalling of the two outboard piles of the access pier at their tops. No ferric bleeding was observed at the spalls.

4.1.3 STRUCTURAL CONDITION ASSESSMENT

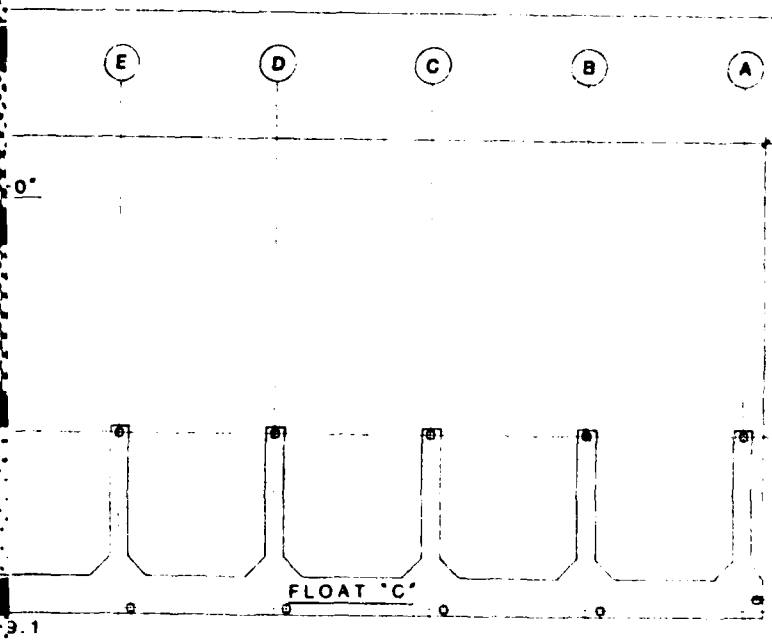
All of the concrete piles are considered in good condition. The spalling of the two outboard piles of the access pier has the appearance of driving fracture and no significant reduction of structural integrity is attached to it.

4.1.4 RECOMMENDATIONS

The supporting structure of Pier 548 is considered in good condition. It is recommended that it be inspected again in six years.

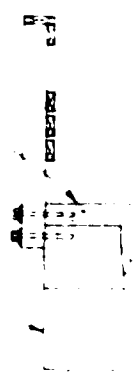


PLAN
1" = 40'



PRECAST, PRESTRESSED
CONC. DOUBLE TEE -

CONC. PILE CAP -



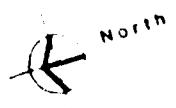
NOTES:

1. ⊗ INDICATES 12" SQ. CONC. PILE
2. ● INDICATES CLEANED PILE
3. -4.0 INDICATES MUD LINE ELEVATION
 MEAN LOWER LOW WATER DATUM - EL. 0+00
4. P.T. -10.0 INDICATES PILE TIP ELEVATION
 MEAN LOWER LOW WATER DATUM - EL. 0+00



TYPICAL
1/4" = 1'

TYPICAL
3/4" = 1'



1. 3



PRECAST, PRESTRESSED
CONC. DOUBLE TEE

4x6 AT 4'-6" O. C.

EL. +12.0

CONC. PILE CAP

12" SQ. CONC. PILES

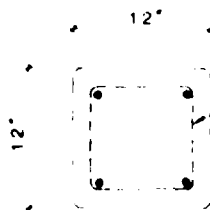
EL. 0+00
M.L.L.W

APPROX. PRESENT
BOTTOM CONFIGURATION

PILE TIP ELEVATION
VARIES - SEE PLAN

TYPICAL PIER SECTION

1/4" 1'-0"



REINFORCING
CONFIGURATION
UNKNOWN

TYPICAL PILE SECTION

3/4" 1'-0"

PIER 548
PLAN AND TYPICAL SECTIONS
NAVAL TRAINING CENTER, SAN DIEGO, CALIFORNIA

Blaylock-Willis and Associates

DATE

OCT. 1984

FIG. 3

343



1. Pier 548



2. Pier 548, Pile 9-F. Picture is of surface of concrete pile after picking with pointed hammer as described in Section 3.2. The resulting spall is at right end of horizontal scale.



3. Pier 548, Pile 4 F. Picture is of cleaned concrete surface before picking.



4. Pier 548, Pile 4 F. Picture is of cleaned surface after picking with pointed hammer. Spall is 2 inches above right end of scale. Concrete piles are in good condition.

4.2 PIER 445

4.2.1 DESCRIPTION OF THE FACILITY

Pier 445 is located on the West shore of the Boat Channel about 500 feet south of the Naval Training Center's boundary with the Marine Corps Recruit Depot.

No construction drawings of this facility were not available to the inspection team. However, they were informed that the facility was originally constructed in 1923.

The 20 inch octagonal guide piles of the floating section have the appearance of precast prestressed units which were not available in 1923. However, it is very possible that they were part of a later repair.

The Pier consists of an access pier, a brow and a floating section. The floating section comprises a central pier with two floating wings on the North and South sides.

The access pier is supported on five two pile bents of which four are exposed and the presumed fifth hidden in the bank at the inboard end of the structure. The deck is of wood framing and planks.

The central part of the floating section is guide supported by the two 20 inch octagonal piles located at the outboard and inboard ends. The northwesterly wing or finger pier is guide supported by three 12 inch diameter wooden piles. The other three wings are cable stayed at their outer corners by steel cables oriented approximately 30° away from the axis of the fingers, sloping to the mudline and apparently to anchors below the mudline.

4.2.2 OBSERVED CONDITIONS

The concrete piles, the 20 inch octagonal and the 12 inch square were tested and all found to rate "firm" on the scale of hardness.

The primary float structure appeared to be taking in water as it was listing about 12" to the southwest.

All three timber guide piles exhibit limnoria damage with approximately an inch of surface loss.

On the access pier, the 12 inch piles show some slight cracking and ferric bleeding at their tops. The connection of the piles to their caps has the appearance of a precast connection with a dry-pack cement material placed after the cap was set. This material is decomposing.

The still cables staying the outer ends of the finger floats are frayed and rusted.

4.2.3 STRUCTURAL CONDITION ASSESSMENT

The 20 inch octagonal piles are in very good condition. The 12 inch square piles are considered fair to good. The cracking and bleeding observed is not considered serious enough to impair their strength. While the bleeding represents rusting and swelling of the imbedded reinforcing steel, repair of the condition is not yet recommended. The deteriorating dry-pack material represents a loss of joint integrity.

Treated wood piling in San Diego Bay is considered to have a service life of seven to ten years. The three guide piles have presently lost most of their surface treated wood. Their remaining service life is considered to be four years.

4.2.4 RECOMMENDATIONS

It is recommended that the joint material at the connection of pile to beam or cap on the access pier be replaced with a simple portland cement dry-pack where it has deteriorated, that the wooden guide piles be replaced in four years and that the pier be reinspected in six years.

7

6

5

4

3

2

1

14'-3" , 15'-0" , 15'-0" , 15'-0"

E

D

C

B

A

61'-0"

15'-8"

8'-8"

FLOAT

63'-8"

FLOAT

TIES - TYPIC

8'-8"

FLOAT

RAMP

-5.2

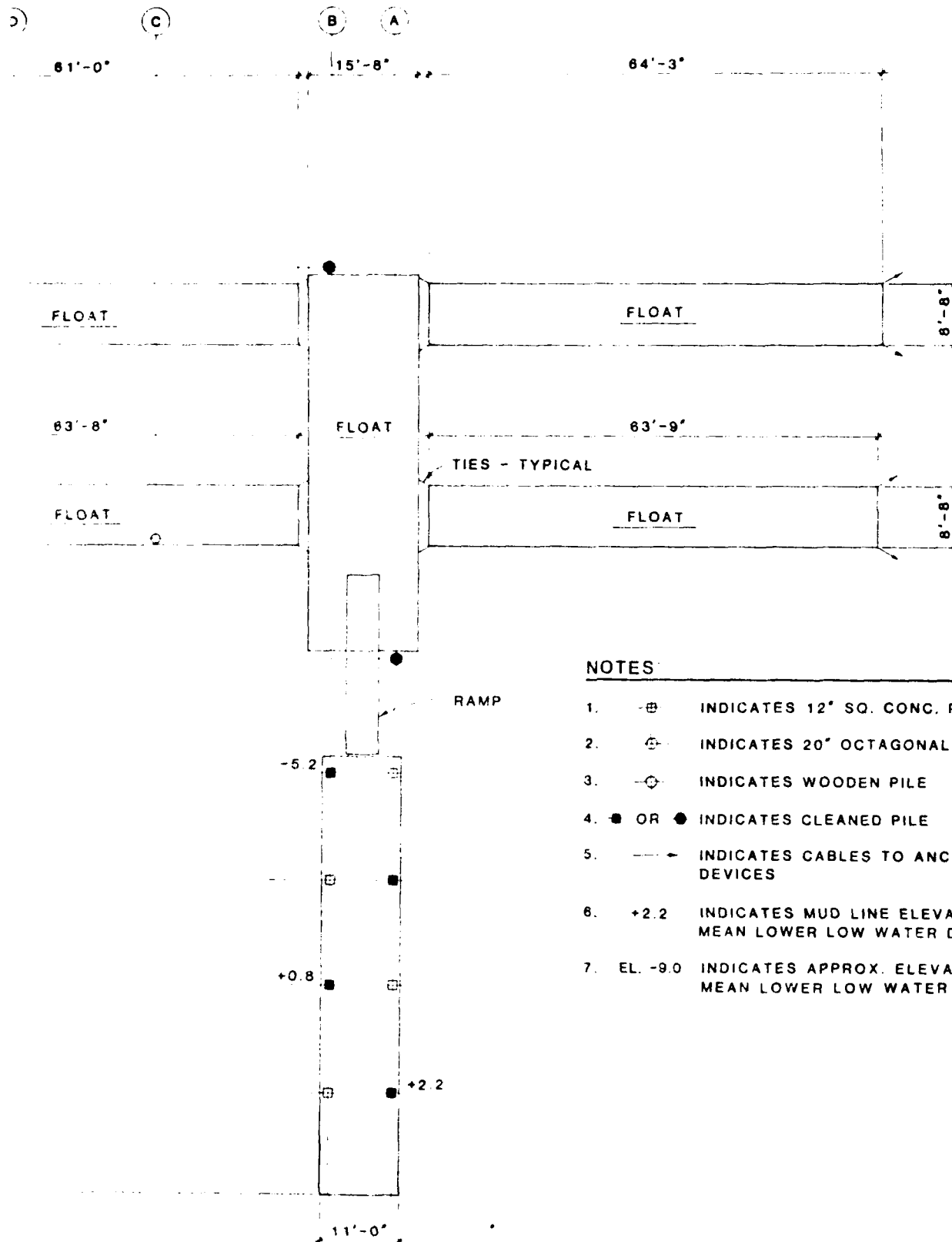
+0.8

+2.2

11'-0"

PLAN

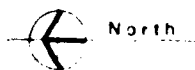
1" = 20'

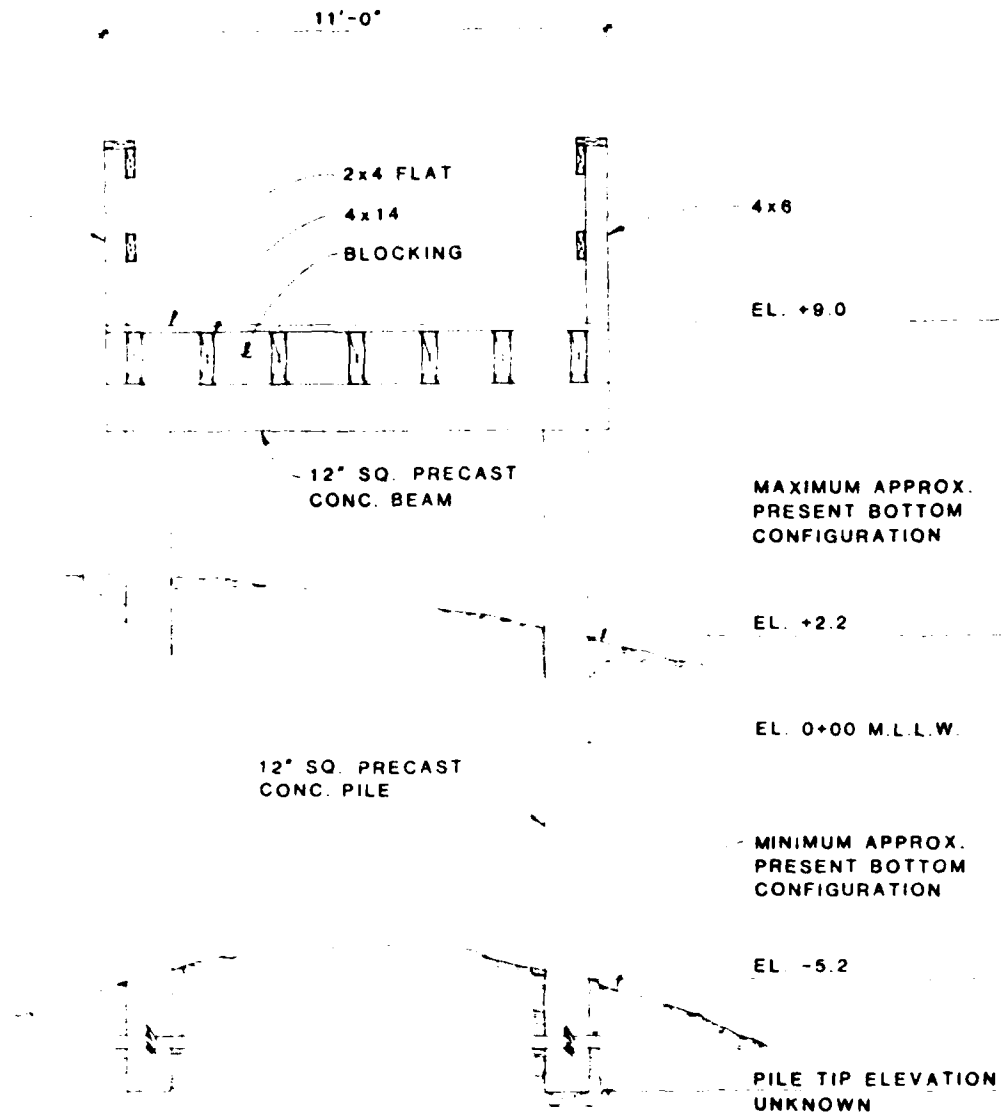


NOTES

1. INDICATES 12" SQ. CONC. PILE
2. INDICATES 20" OCTAGONAL CONC. PILE
3. INDICATES WOODEN PILE
4. OR INDICATES CLEANED PILE
5. INDICATES CABLES TO ANCHORING DEVICES
6. +2.2 INDICATES MUD LINE ELEVATION, MEAN LOWER LOW WATER DATUM - EL. 0+00
7. EL. -9.0 INDICATES APPROX. ELEVATION MEAN LOWER LOW WATER DATUM - EL. 0+00

PLAN
1" = 20'





TYPICAL PIER SECTION

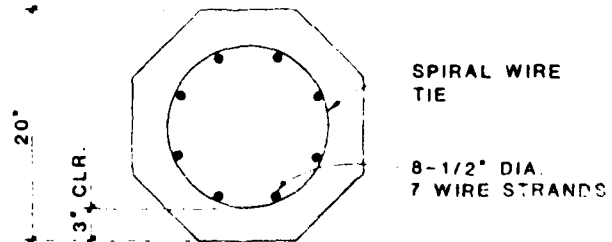
1/4": 1'-0"



TYPICAL PILE SECTION

12" SQ. CONC. PILE

1/4": 1'-0"



TYPICAL PILE SECTION

20" OCTAGONAL CONC. PILE

3/4": 1'-0"

PIER 445 PLAN AND TYPICAL SECTIONS

NAVAL TRAINING CENTER, SAN DIEGO, CALIFORNIA

Blaylock-Willis and Associates

DATE:

STRUCTURAL ENGINEERS SAN DIEGO, CALIFORNIA

OCT. 1984

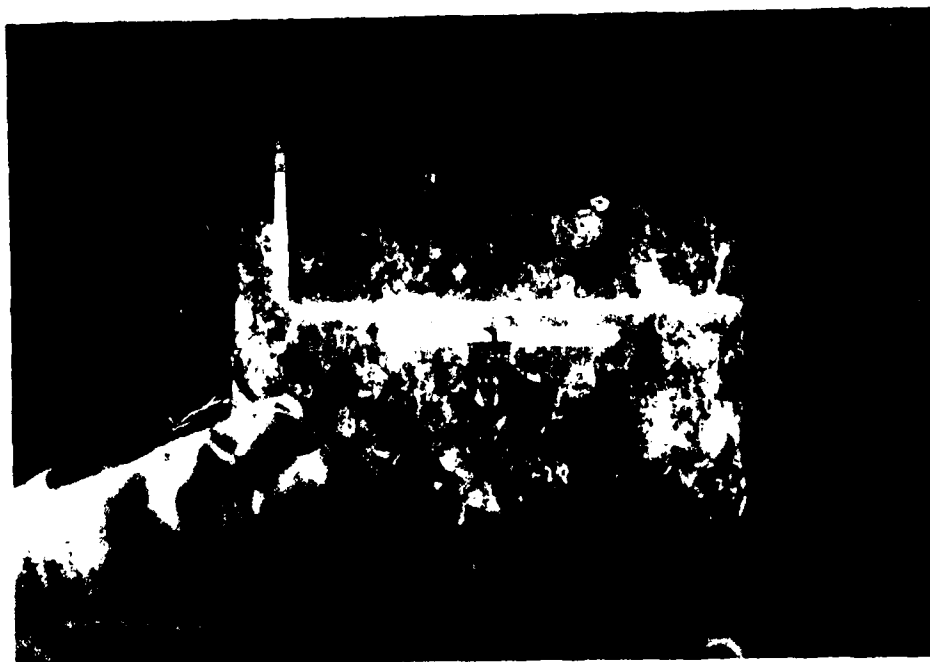
FIG. 4



5. Pier 445.



6. Pier 445, Pile 1-B. The joint shown has the appearance of a joint between precast elements. The dry-pack material used to achieve level bearing has deteriorated.



7. Pier 445, Pile 4-B. Picture is of cleaned concrete surface of 12 inch square pile, before picking with pointed hammer.



8. Pier 445, Pile 4 B. Picture is of cleaned concrete surface after picking. Resulting spall is 3 inches above horizontal scale at right.



9. Pier 445, Pile 7-B. Picture is of cleaned surface of 20 inch octagonal pile before picking with pointed hammer.



10. Pier 445, Pile 7-B. Picture is of cleaned surface after picking. The resulting spall appears above the 7 on the horizontal scale.

4.3 BULKHEADS

4.3.1 DESCRIPTION OF THE FACILITY

There are five separate sections of bulkhead at the Naval Training Center. Listed from their locations South to North, they are:

1. South Boundary Bulkhead
2. Pier 548 Bulkhead
3. Pier 446 Bulkhead
4. Pier 445 Bulkhead
5. North Boundary Bulkhead

No construction drawings of any of these structures could be found by the inspection team. As a result, their below surface configurations can only be estimated and the means by which they maintain static stability can only be presumed from experience.

The South Boundary Bulkhead is composed of two types of cross section. Using the intersection with the ASW fence as Station 0+00, the sections from Station 0+00 to 0+69 and Station 1+24 to the north limit of the wall are composite sections. They comprise three elements. A precast lower panel 6 inches thick by 4 foot horizontal and of unknown length - extending from approximately Elevation 6+00 MLLW to an unknown distance below the mudline. A 12 inch high by 15 inch wide cast-in-place beam cap is located at the top of the precast section. Above the cast-in-place section, a slab extends seven feet at about 22° to the elevation of level ground.

Between Stations 0+69 and 1+24, the wall appears to be a cast-in-place gravity wall.

The Bulkhead at Pier 548 extends south from the Pier about 87 feet. It has a vertical face and the appearance of a

cast-in-place concrete section. The waterside face of the wall is covered with large pieces of concrete rip-rap. The top of wall is at level ground and indicates a stem thickness of 8 1/2 inches.

At Pier 446, the Bulkhead is a wooden structure composed of wood soldier piles at approximately 4' O.C. with 2 x 12 plank lagging placed horizontally. The wall is about 118 feet in length and centered on the Pier. The piles provide stability by cantilever from the mudline - 6 feet maximum. The top of the Bulkhead is at level ground - asphalt paved and available to parking vehicles.

The Bulkhead at Pier 445 is approximately 28 feet in length extending 26 feet south of the Pier. It is also of wood construction, composed of two horizontal wood wales with vertical 6 x 12 lagging behind. The top of the wall is at level with a concrete paved surface.

The Bulkhead at the North Boundary of the Training Center is also a wooden structure. It extends approximately 85 feet south of the fence which separates the Center from the Marine Corps Recruit Depot. The top of the wall is at level ground and about seven feet from the parallel fence which marks the limit of a paved parking area beyond.

4.3.2 OBSERVED CONDITIONS

The concrete Bulkhead at the South Boundary exhibits no symptoms of deterioration or distress. It has two vertical cracks - 69 feet and 124 feet north of the boundary fence. The cracks occur at changes in the wall cross section and small voids appear to be forming behind the wall at these locations.

The concrete Bulkhead at Pier 548 shows no symptoms of deterioration but is, however, undermined for approximately 18

feet between Stations 0+57 and 0+75 measuring from the North end. The Bulkhead is 41 inches high measured at the undercut and has a total footing width of 12 inches. It has a slight bulge in the direction of the water and a slight lean in the direction of the water.

The undercut measures 7 inches vertically and has a depth in excess of 24 inches.

At Pier 446, the Bulkhead exhibits a classic case of dry rot decay. The bottom of the wall, at the mudline, is below water at high tide. The piles have surface symptoms of dry rot although no pile is completely decayed through. However, the 2 x 12 lagging is completely decomposed in several places exposing rip-rap backfill. There is no evidence of surface subsidence behind the wall.

Pier 445 Bulkhead is in very poor condition. The bottom of the wall also is in water at high tide and has completely decomposed in a 7 foot section adjacent to the Pier. The lower wale is not continuous or even aligned as though the wall were built in two sections at different times. Both lagging and wales exhibit dry rot.

Adjacent to the Pier, the missing lower section reveals a concrete surface behind it as though a cyclopean section exists in this area.

At the North Boundary, the wall exhibits similar deterioration to the Bulkhead at Pier 445. The bottom of the wall is in water at high tide and has suffered dry rot damage to both lagging and wales. A large void has occurred in the backfill at the north end of the wall.

At 8 foot centers along the wall, a large square washer connection detail suggests that the wall is dead-man tied to an anchoring device buried in the backfill.

4.3.3 STRUCTURAL CONDITION ASSESSMENT

As described above, there are no symptoms of distress at the South Boundary Bulkhead. The vertical cracks in the wall appear to be construction joints and represent no threat to the walls integrity. The small voids forming behind the crack can be filled with a lightly cemented soil very easily by station personnel.

The Pier 548 structure appears to be a reinforced cantilever section with a footing behind the wall beneath the backfill. However, from measurements taken at the undermined area, the depth (the distance measured perpendicular to the wall) of the footing appears to be inadequate. This could account for the bulge and slope now exhibited by the stem.

At Pier 446, the wall is obviously badly damaged and clearly its ability to sustain loads is reduced. It was noted that the area behind the wall is paved and used for parking of vehicles and equipment. Although there is no present indication of surface subsidence or wall movement, there is a possibility of wall failure under heavy surcharge.

It is not clearly indicated how the Pier 445 Bulkhead achieves its static stability. The bolt heads exposed at the wales do not have the appearance of dead-man tie ends but rather of through bolts for front and rear wales. The exposed concrete at the base of the wall appears to be limited to the 7 foot section adjacent to the Pier. There is evidence of surface subsidence behind the 7 foot section.

The North Boundary Bulkhead appears to be stabilized by ties extending back into the backfill. The presence of the ties is also strongly suggested by the performance of the wall. It is either tied or cantilevered out of the mudline. The latter possibility seems very remote as there is virtually no sound wood cross section still existing at the mudline. The wall appears to be stable with no sloping or bowing visible. The large void at the north end

appears to be the mode of failure with soil slipping through the base as it further deteriorates. It is felt that the wall is far enough from the fence of the parking lot so that its failure would not represent a threat to the parked vehicles.

4.3.4 RECOMMENDATIONS

It is recommended that:

1. The two small voids behind the South Boundary Bulkhead at Stations 0+69 and 1+24 be filled with a soil-cement material to prevent further erosion at these locations and the wall inspected again in six years. Estimated cost of repair is \$1,000.
2. The 18 foot undercut of the Pier 548 Bulkhead be filled with lean concrete placed through excavated holes from the landside, and the wall inspected again in six years. Estimated cost of repair is \$1,000.
3. The Bulkhead at Pier 446 be replaced within two years or the vehicle parking behind the wall restricted. The estimated cost of replacement is the sum of \$79,600 (See Section 5 for a detailed cost estimate). It is also recommended that the new wall be inspected after its completion.
4. The Pier 445 Bulkhead be replaced as soon as possible and the vehicle parking adjacent to the wall restricted. The cost of replacement is estimated as \$33,800 (See Section 5 for a detailed cost estimate). It is recommended that the new wall be inspected when completed.

5. The North Boundary Bulkhead be replaced if the condition of the shoreline is a concern of the Training Center. No threat to life or property (except shoreline) is represented by this deteriorating wall. The cost of replacement is estimated to be \$62,800 (See Section 5 for a detailed cost estimate). It is recommended that the wall be inspected when completed.

NAVAL TRAINING CENTER

ANTI-SUBMARINE WARFARE
TRAINING CENTER

SOUTH BOUNDARY
BULKHEAD

NAVAL STATION
PIER 9

PIER 548
PIER 548
BULKHEAD

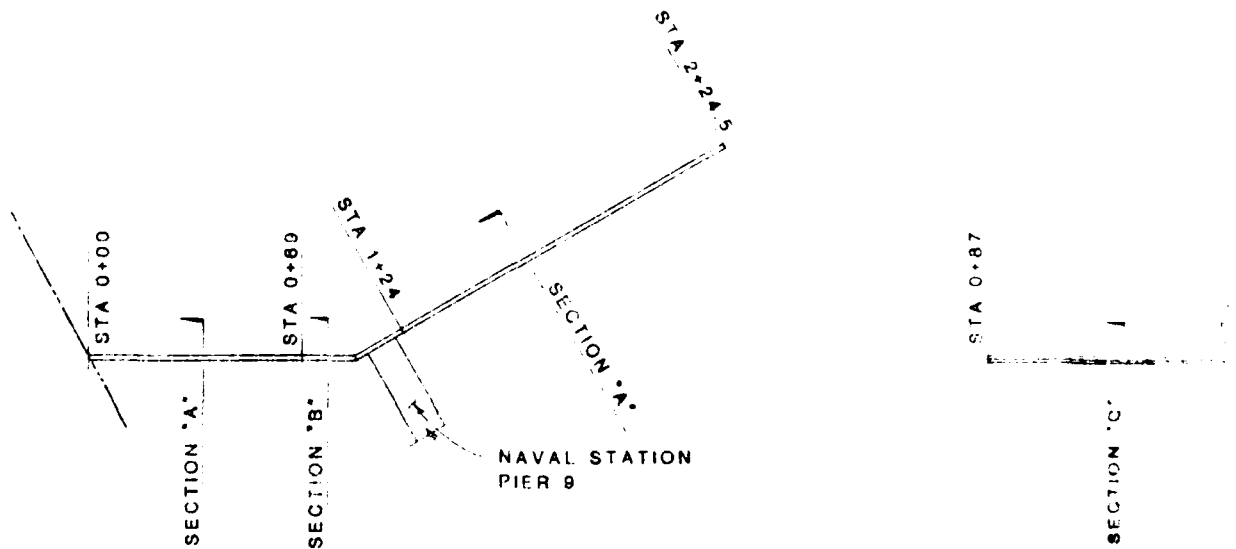
HARBOR DRIVE BRIDGE

BRIDGE 80

NAVAL TRAINING

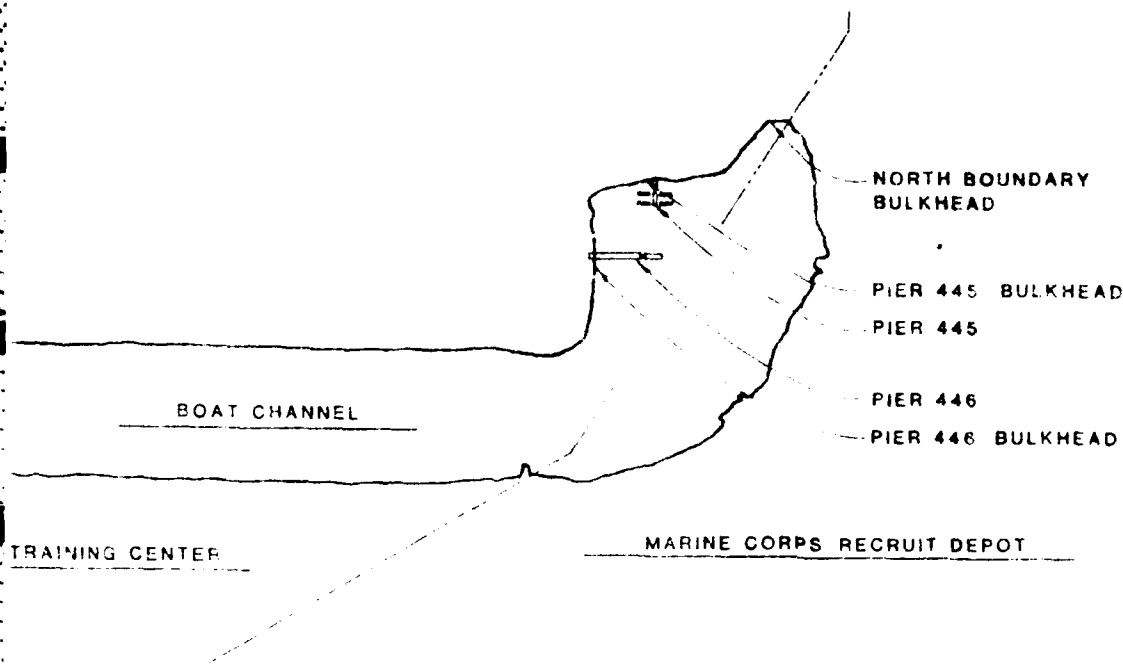
SAN DIEGO BAY

KEY
60 5



SOUTH BOUNDARY BULKHEAD
1"=60'

PIER 548 BULKHEAD
1"=60'



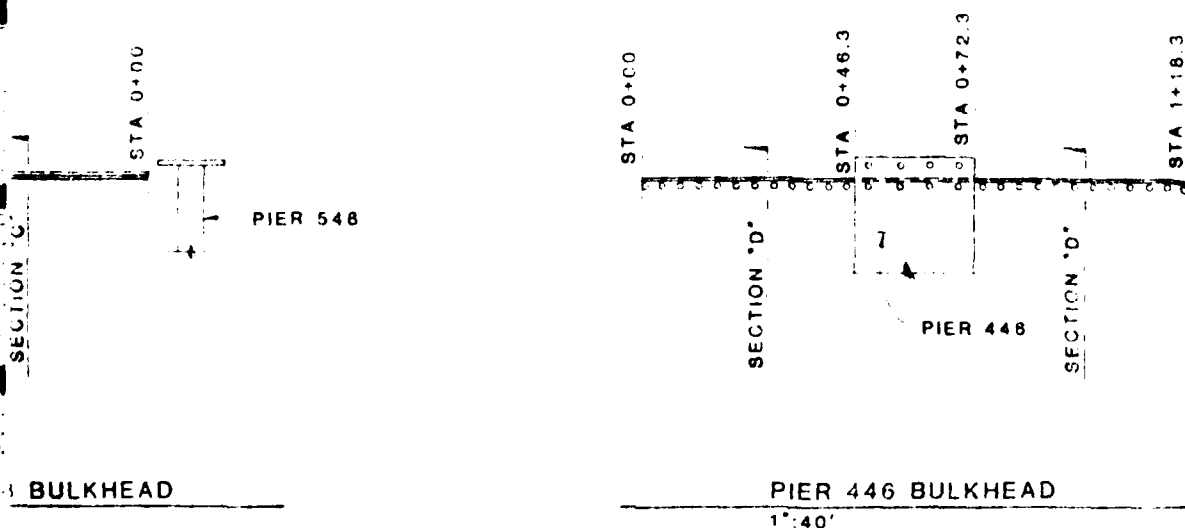
KEY PLAN
NO SCALE

North



NOTES:

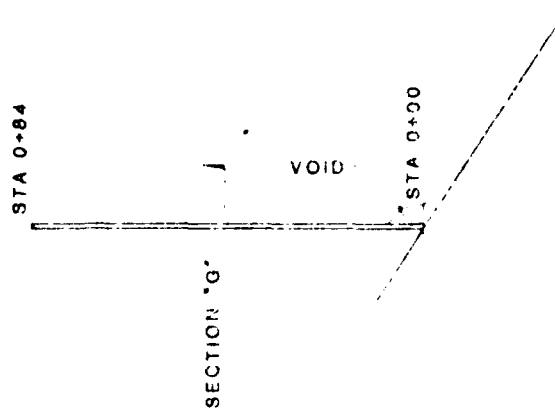
1. FOR SECTIONS CUT ON THESE PLANS SEE FIGURE 6



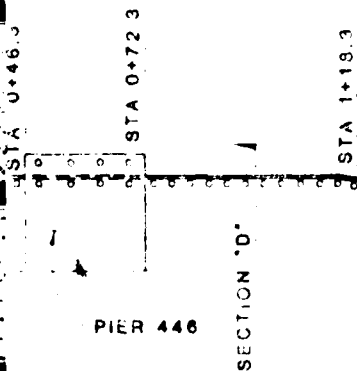
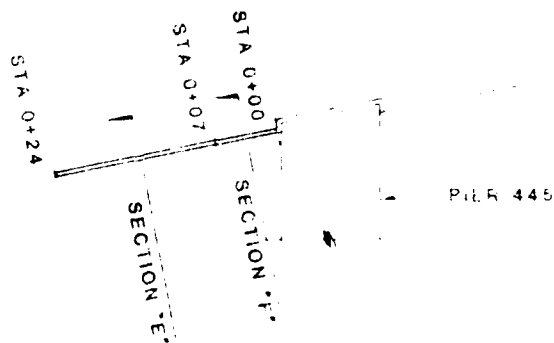
PI

- NORTH BOUNDARY BULKHEAD
- PIER 445 BULKHEAD
- PIER 445
- PIER 446
- PIER 446 BULKHEAD

RECRUIT DEPOT



ES
FOR SECTIONS CUT ON THESE PLANS SEE FIGURE 6



BULKHEAD PLANS

NAVAL TRAINING CENTER, SAN DIEGO, CALIFORNIA

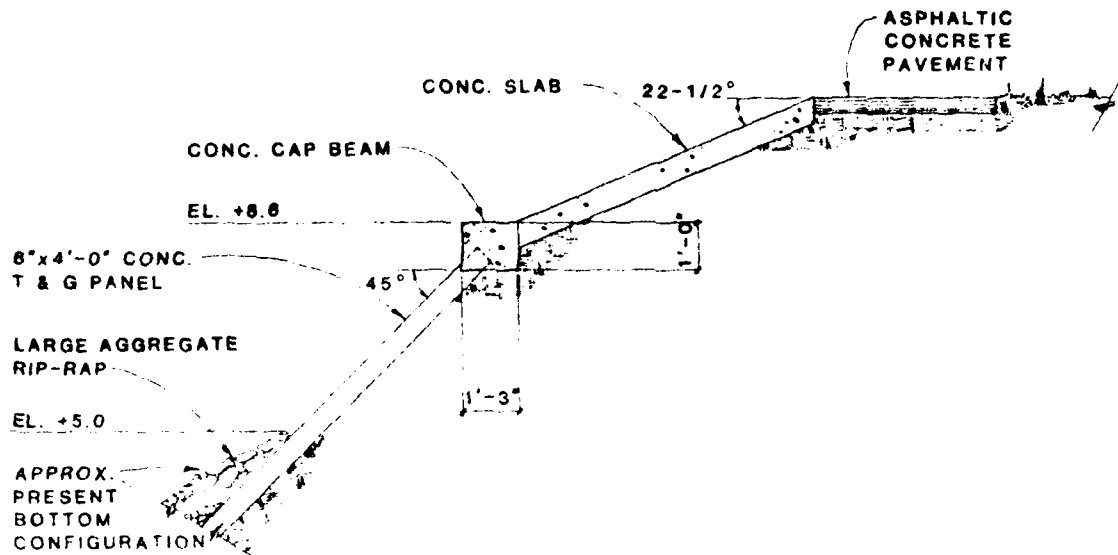
Playlock-Willis and Associates

DATE:

ENGINEER SAN DIEGO, CALIFORNIA

OCT 1984

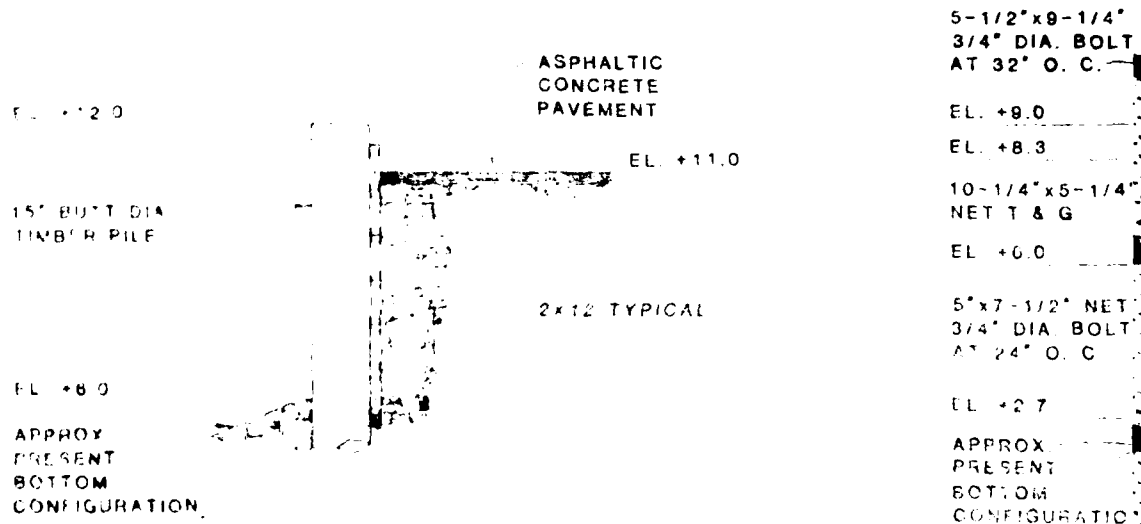
FIG. 5



LARG
AGGR
RIP-R
EL. +
APPR
BOTT
CONF

SECTION "A"

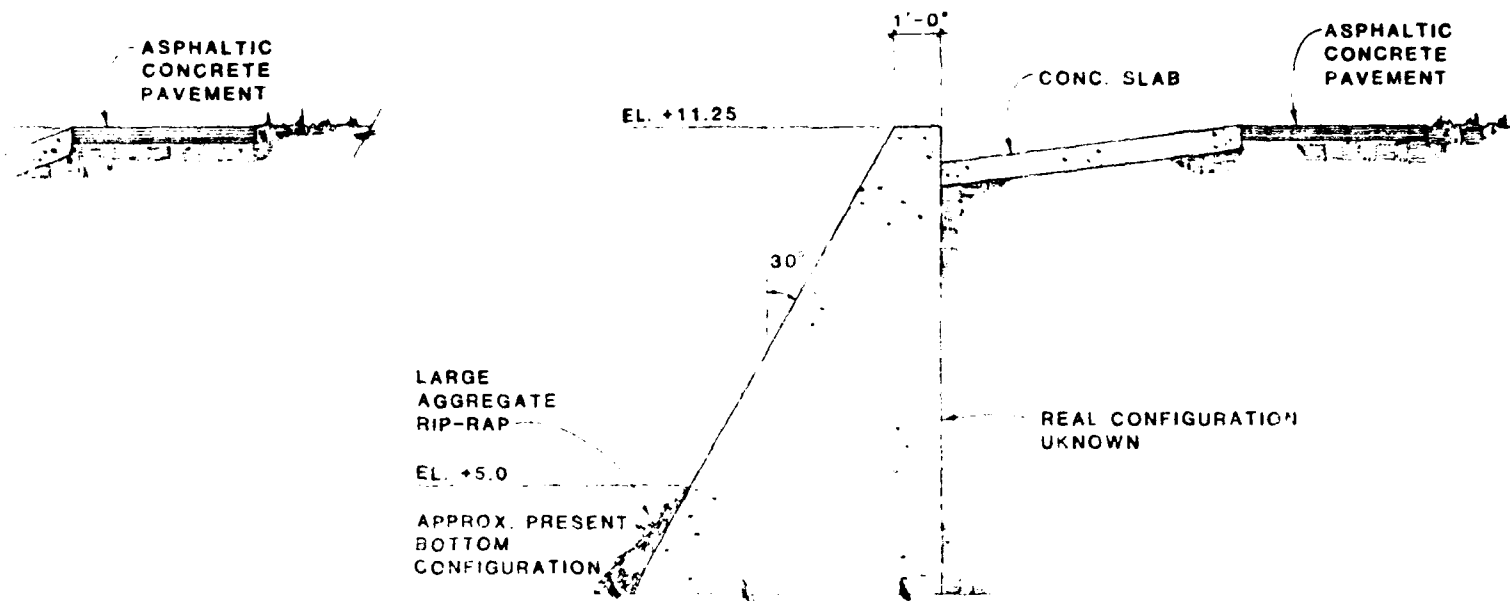
1/4" = 1'-0"



5'-1/2"x9'-1/4"
3/4" DIA. BOLT
AT 32" O. C.
EL. +9.0
EL. +8.3
10'-1/4"x5'-1/4"
NET T & G
EL. +6.0
5'x7'-1/2" NET
3/4" DIA. BOLT
AT 24" O. C.
EL. +2.7
APPROX.
PRESENT
BOTTOM
CONFIGURATIO

SECTION "D"

1/4" = 1'-0"



SECTION "B"

1/4" = 1'-0"

5'-0" x 5'-0" NET W/
3/4" DIA. BOLTS
AT 24" O.C.

CONC. PAVEMENT

EL. +8.0

EL. +8.0

10'-0" x 4'-0" NET W/
3/4" DIA. BOLTS
AT 24" O.C.

EL. +6.0

5'-0" x 5'-0" NET W/
3/4" DIA. BOLTS
AT 24" O.C.

EL. +2.0

APPROX.
PRESENT
BOTTOM
CONFIGURATION

3'-0" x 5'-0" NET W/
5/8" DIA. BOLTS
AT 24" O.C.

EL. +8.8

EL. +8.3

3'-0" x 7'-0" NET T & G

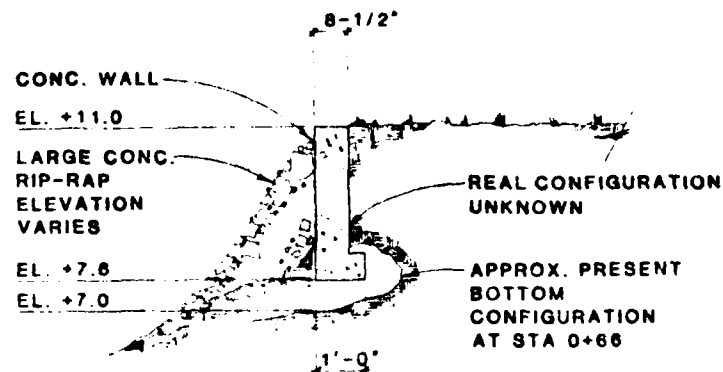
EL. +6.6

6'-0" x 5'-0" NET W/
3/4" DIA. BOLTS
AT 48" O.C. MAX

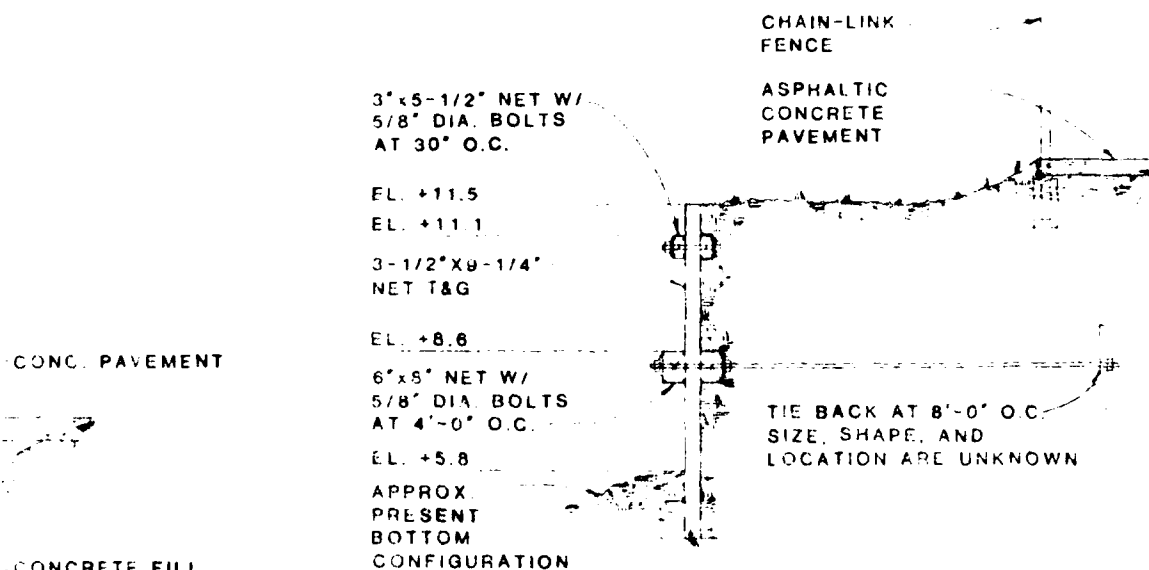
EL. +4.0

APPROX.
PRESENT
BOTTOM
CONFIGURATION

1/4"



SECTION "C"
1/4" = 1'-0"



SECTION "G"
1/4" = 1'-0"

NOTES

1. EL. +8.6 APPROXIMATE ELEVATIONS
MEAN LOWER LOW WATER DATUM EL. 0+00

BULKHEAD SECTIONS

NAVAL TRAINING CENTER, SAN DIEGO, CALIFORNIA

Blaylock-Willis and Associates

DATE:

FIG. 6

STRUCTURAL ENGINEERS SAN DIEGO, CALIFORNIA

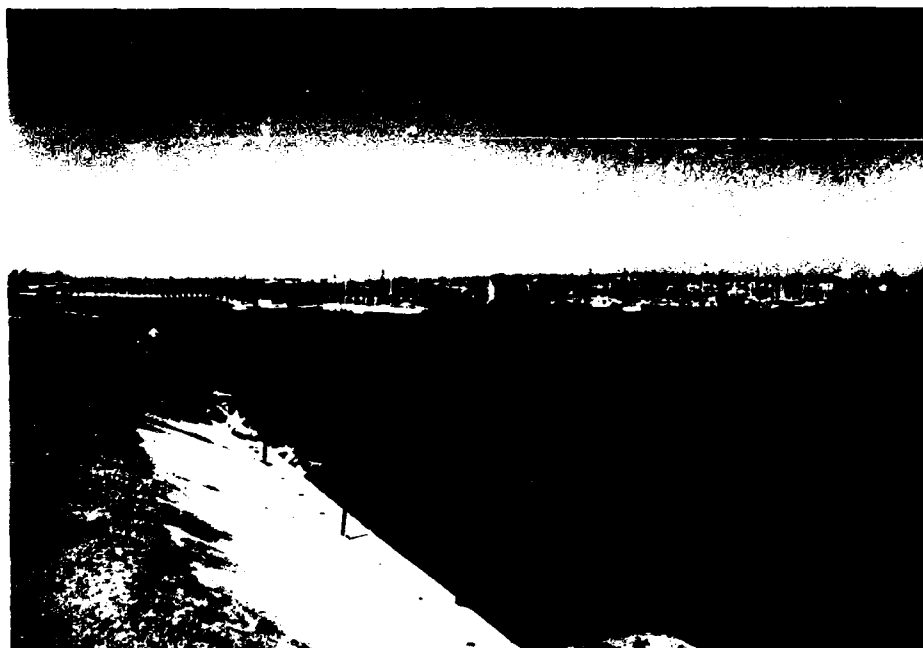
OCT. 1984



11. South Boundary Bulkhead. Picture is taken from the base of Pier 9. View is to the south. Fence in the background represents the south boundary of NTC.



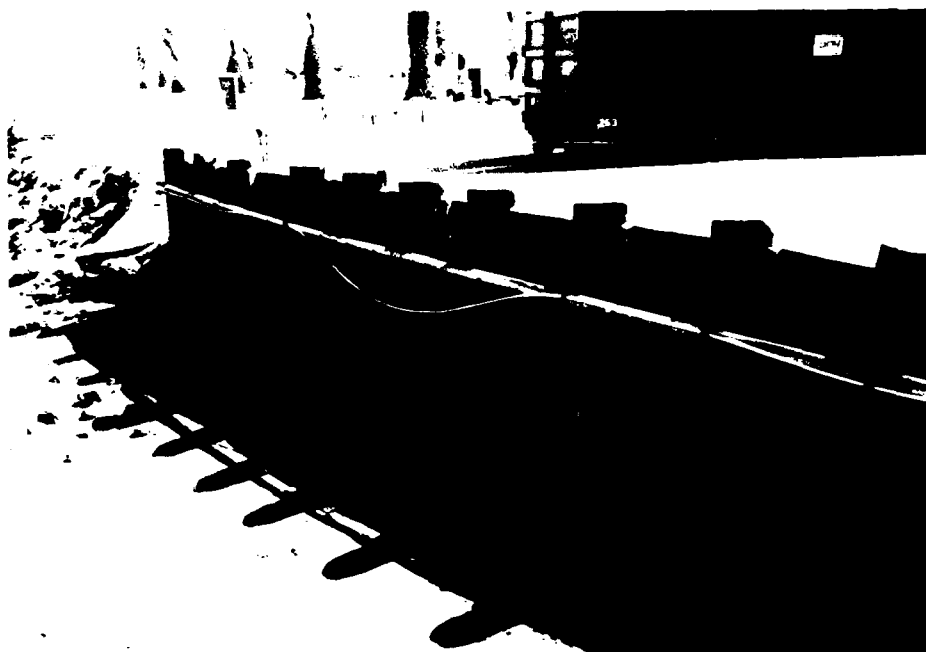
12. South Boundary Bulkhead. Picture is taken from the base of Pier 9. View is to the northwest.



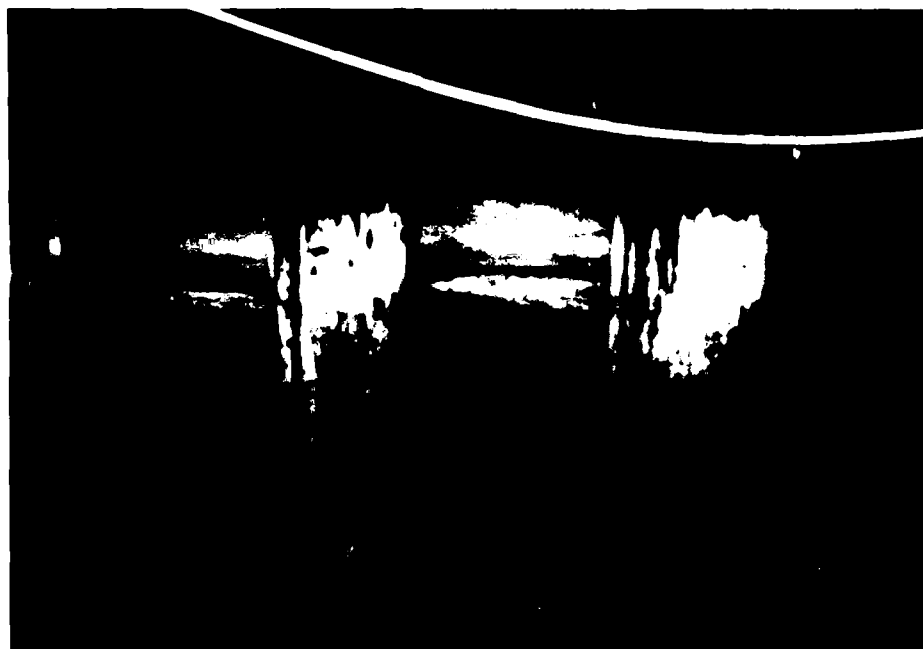
13. South Boundary Bulkhead from base of Pier 9. View is to the northeast. Harbor Island is in right background.



14. Pier 548 Bulkhead. View is from the base of the Pier to the south.



15. Pier 446 Bulkhead. View is from Pier 446 southward showing the south wing of the Bulkhead. Deteriorated lagging is clearly shown.



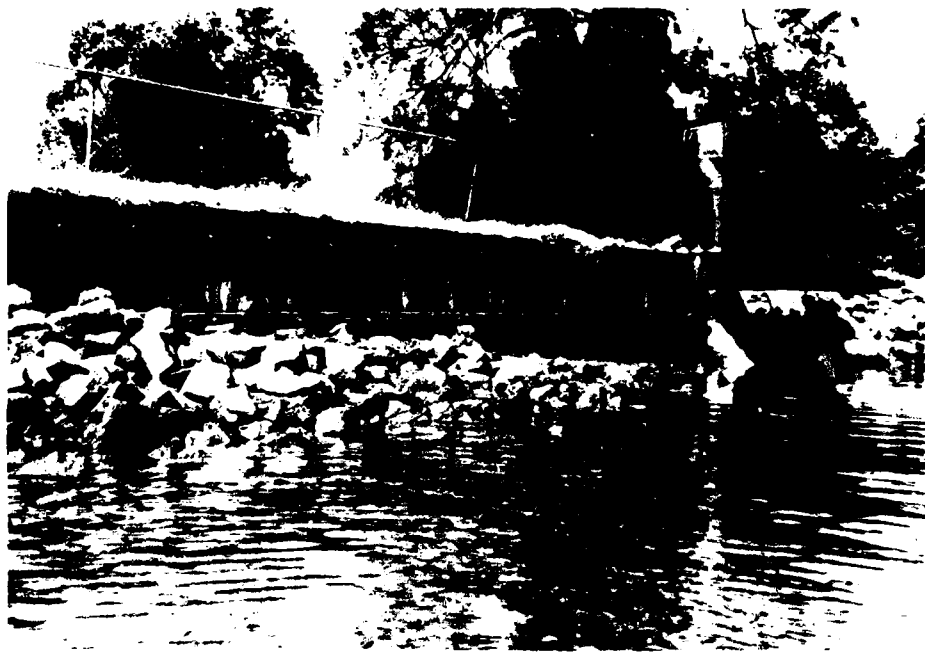
16. Pier 446 Bulkhead. The wooden members are under water at high tide and dry-rot deterioration can be seen in lagging and piles.



17. Pier 445 Bulkhead. View is of the base of the Bulkhead taken at low tide. The vertical lagging has completely rotted away below the lower wale revealing concrete and rubble behind the wall. There is evidence of surface subsidence in the pavement above this location. It is not clearly demonstrated.



18. Pier 445. View is of surface depression above deteriorated Bulkhead.



19. North Boundary Bulkhead. Fence in the right foreground is the boundary with Marine Corps Recruit Depot. The wood has deteriorated from dry rot.



20. North Boundary Bulkhead. A closer view reveals the deterioration of both wales and lagging. The wall apparently is stable due to tie-back rods extending to dead men anchors in the backfill. This is evidenced by the large square washer connections seen at the lower wale.

4.4 BOAT RAMP 529

4.4.1 OBSERVATION AND RECOMMENDATION

The inspection and assessment of the Boat Ramp was not a formal item in the Scope of Work for this contract. However, Lt. Cdr. Reynolds expressed concern regarding a problem at the Ramp and its investigation was considered appropriate to this study.

The Ramp is located at the north end of the Boat Channel midway between Pier 445 and the North Boundary of NTC. It is 14' wide and 64' long. Its outer end is at Elevation -4.0 MLLW, approximately.

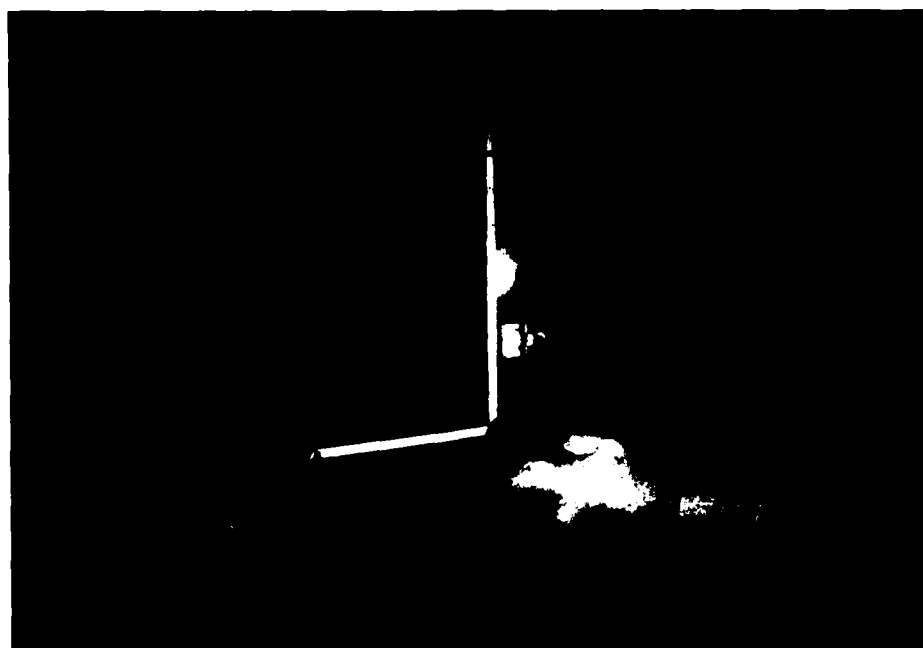
The problem appears to occur at low tide when boats on wheeled cradles are being taken out of the water. There is an abrupt drop at the end of the Ramp which causes cradle wheels to hang up.

Inspection revealed the drop to extend all across the end of the Ramp but being maximum at the northeast corner where the 6 inch slab is undermined in excess of 12 inches vertically. The resulting void extends about five feet under the concrete and about halfway across the end of the Ramp.

It is recommended that a sufficient volume of 1 1/2 inch aggregate be deposited at the end of the Ramp to smooth out the drop and fill the void. It is estimated that the cost would be \$2,500.



21. Boat Ramp 529. Viewed inboard from the water.



22. Boat Ramp 529. Picture is taken of the eastern corner of the end of ramp showing the existing void.

SECTION 5 - APPENDICES

5.1 PERSONNEL ON PROJECT

1. Chesapeake Division Personnel:
Phillip Scola - Program Manager
Wade Casey - EIC
Christopher Crilley - EIT
2. Blaylock-Willis and Associates Personnel:
A.J. Blaylock - Civil/Structural Engineer, Diver
James Willis - Civil/Structural Engineer, Diver
Daniel McNaughton - Civil/Structural Engineer, Diver
Matthew Martinez - Civil Engineer, Diver
Carson Creecy - Civil Engineer, Diver
Thomas Spencer - Civil Engineer, Diver
Darrell Williams - Structural Technician -Tender
3. Testing Engineers Inc. Personnel:
Tony Rychell - Ultrasonic Equipment Technician
4. Studio B Photography Personnel:
Lee Peterson - Underwater Photographer

5.2 COST ESTIMATES

ACTIVITY: NAVAL TRAINING CENTER
SAN DIEGO, CA.

SPECIFICATION NO. A-E FIRM NAME:
BLAYLOCK-WILLIS

SHEET 1 OF 3

PROJECT TITLE: ESTIMATED BY: CHECKED BY: DATE: September 24, 1984

PIER 446 BULKHEAD STATUS: J.O. NO.: 1644-06

DESCRIPTION	QUANTITY NUMBER UNIT	MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
		UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
Move On-Move Off	L.S.						5,000
Demolition	L.S.						10,000
PZ27 - 27x20' = 540 PLF x 118'	63,720 L.B.	0.50	31,860	0.20	12,740	0.70	44,600
Concrete Cap Form, Reinforce, Cast	118 L.F.					100	11,800
Excavation & Backfill	130 C.Y.					23	3,000
Repave	1200 S.F.					2.10	2,500
							76,900

ACTIVITY: NAVAL TRAINING CENTER
SAN DIEGO, CA.

SPECIFICATION NO. A-E FIRM NAME: BLAYLOCK-WILLIS
SHEET 2 OF 3

PROJECT TITLE: ESTIMATED BY: Robert Whitelaw
DATE: September 24, 1984

PIER 445 BULKHEAD
STATUS: J.O. NO.: 1644-06

DESCRIPTION	QUANTITY NUMBER UNIT	MATERIAL COST UNIT COST TOTAL	LABOR COST UNIT COST TOTAL	ENGINEERING ESTIMATE UNIT COST TOTAL
Move On-Move Off	L.S.			5,000
Demolition	L.S.			7,000
PZ27 - 27x20'=540 PLF x 30'	16,200 L.B.	0.50 8,100	0.20 3,200	.70 11,300
Concrete Cap Form, Reinforce, Cast	30 L.F.			100 3,000
Excavation & Backfill	40 C.Y.			35 1,400
Repave	450 S.F.			2.50 1,100
Miscellaneous Pier Repairs	L.S.			5,000
				33,800

ACTIVITY:		SPECIFICATION NO.		A-E FIRM NAME:		SHEET 3 OF 3	
NAVAL TRAINING CENTER				BLAYLOCK-WILLIS			
SAN DIEGO, CA.							
PROJECT TITLE:		ESTIMATED BY:	CHECKED BY:	DATE:		October 17, 1984	
			Robert Whitelaw				
NORTH BOUNDARY BULKHEAD		STATUS:	J.O. NO.:		1644-06		
DESCRIPTION		QUANTITY	MATERIAL COST	LABOR COST	ENGINEERING ESTIMATE		
		NUMBER UNIT	UNIT COST TOTAL	UNIT COST TOTAL	UNIT COST TOTAL		

Move On-Move Off	L.S.					5,000
Demolition	L.S.					5,000
PZ-27 - 27x20'=540 PLF x 90'	48,600 L.B.	0.50	24,300	0.20	9,700	34,000
Concrete Cap	90 L.F.				100	9,000
Form, Reinforce, Cast					25	9,800
Excavation & Backfill	390 C.Y.					62,800

5.3 TABLES OF STRUCTURAL ASSESSMENT

TABLE 5.1

RECORD OF STRUCTURAL ASSESSMENT

PIER 548

DESCRIPTION OF PILE CONDITION				
PILE	TOP	MIDDLE	BOTTOM	STRUCTURAL COMMENTS
B10	Firm	Firm	Firm	
F4	-----	-----	Firm	
F5	-----	-----	-----	Small spall near top of pile
F9	Firm	Firm	Firm	
G5	-----	-----	Firm	Small spall near top of pile
J8	Firm	Firm	Firm	
K9	Firm	Firm	Firm	
M10	Firm	Firm	Firm	

TABLE 5.2
RECORD OF STRUCTURAL ASSESSMENT

PIER 445

DESCRIPTION OF PILE CONDITION				
PILE	TOP	MIDDLE	BOTTOM	STRUCTURAL COMMENTS
A1	-----	-----	Firm	Small vertical crack at pile cap
A2	-----	-----	-----	Vertical crack at south face of pile cap
A3	Firm	-----	Firm	
A4	-----	-----	-----	Vertical crack with bleeding at south face of pile cap
A5	Firm	Firm	Firm	
B1	-----	-----	-----	Vertical crack at south face of pile cap
B2	-----	-----	Firm	Vertical crack at south face of pile cap
B4	Firm	-----	Firm	Vertical crack at south face with bleeding
B7	Firm	Firm	Firm	
C6	-----	-----	-----	Wooden pile - Level I only 1" penetrations
D6	-----	-----	-----	Wooden pile - Level I only 1" penetrations
E6	-----	-----	-----	Wooden pile - Level I only 1" penetrations

TABLE 5.3

RECORD OF STRUCTURAL ASSESSMENT

SOUTH BOUNDARY BULKHEAD

DESCRIPTION OF QUAYWALL CONDITION					
QUAYWALL		TOP	MIDDLE	BOTTOM	STRUCTURAL COMMENTS
Station	Type				
0+00	Concrete	-----	-----	Firm	
0+69	Concrete	-----	-----	-----	Crack at bulkhead transition joint. 18" void behind wall.
1+24	Concrete	-----	-----	-----	Crack at bulkhead transition joint. 24" void behind wall.
2+00	Concrete	-----	-----	Firm	

5.4 BIBLIOGRAPHY

BIBLIOGRAPHY

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2. Naval Training Center "Basic Facility Requirements", Draft Submittal, September, 1982, Public Works Center, Naval Station, San Diego, California.
3. San Diego Unified Port District "Environmental Impact Report on Master Plan", February, 1980, SDUPD Planning Department.
4. San Diego Unified Port District, 1982a, "Natural Physical Factors of the San Diego Tidelands", January, 1972, SDUPD Planning Department.

END

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